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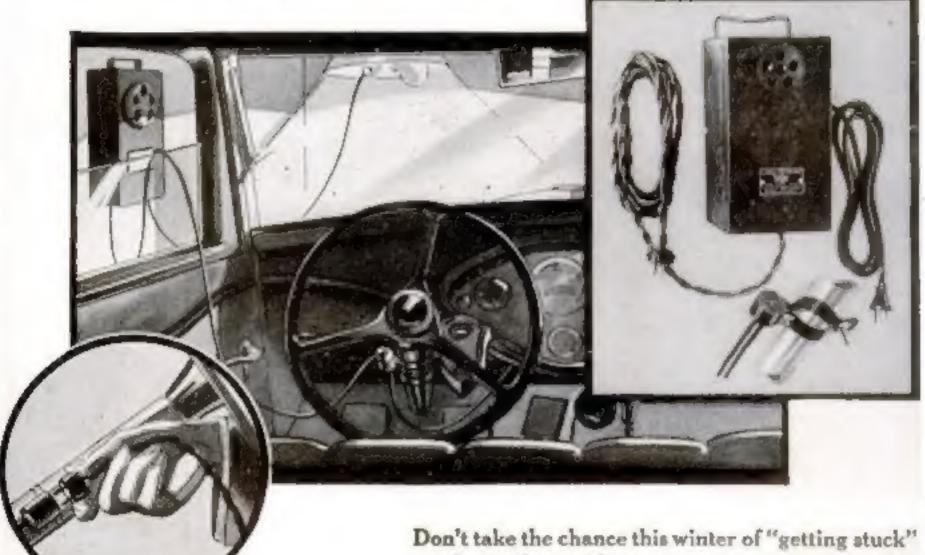
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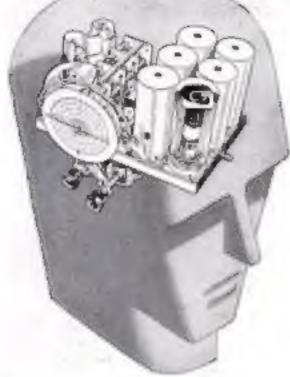


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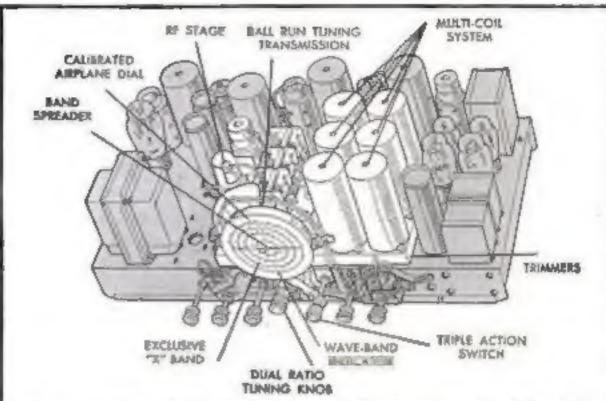
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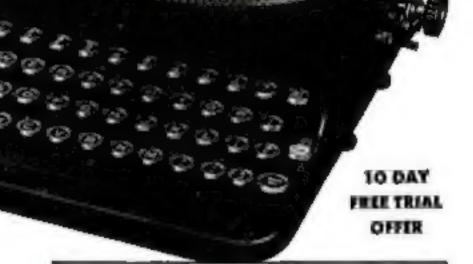
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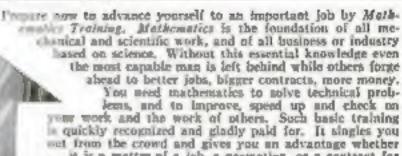
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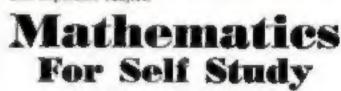
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STRANGE, BUT TRUE



(A) CANNED SPIGOT WATER... sold for big money in the U.S. last year and thousands of people bought II. Why? (See answer below.)

(B) IN LITTLE AMERICA..... where 60 degrees below zero is not uncomman, water-cooled motors operate without slanger of freeze-up. New are such motors protected (See answer below.)

(C) ENGINES OF MODERN HIGH-SPEED CARS... are designed to deliver maximum power at relatively high coolingsystem temperatures. Yet fats of people still use old-fashioned anti-freeze which balls away before such temperatures are reacted. Why? (See accord below.)

- (A) They didn't know that many anti-freezes contain 10 to 40% plain spiget water. When you buy Eveready Presions you get a concentrated enti-freeze; you add the necessary water yourself... you don't pay for genning and shipping it.
- (A) Water-cooled motors in planes, snewmebites and ice plants are protected with Everandy Presions—chasen as the sloodard anti-freeza for Byrd Antarctic Expedition No. 2 because of satisfactory performance on the first Antarctic Expedition.
- (C) Sections they think ball-away enti-fracts is cheaper. Actually it is cheaper only at first. In the long run the least expensive all-Winter protection against both fracta-up and rust is provided by Eveready Prestane, (See chart on page 76).)

Eveready Prestone is a concentrated anti-freeze. One shot is guaranteed to protect your car all Winter from freeze-up and rest. Economical, too. See chart on Page 768 for cast on your car and full Eveready Prestone gueronise.

TURN TO PAGE 768



Squeaks can be taken out of Score by nailing down the lease ends of heards

SPARE-TIME

Floor Repairs

By R. M. BOLEN

Secretary, Popular Science Institute

OTHING is more important to the general appearance of your home than the condition of its floors. A cracked ceiling may go unnoticed, but even a slight scratch or spot on a floor invariably stands out like a sore thumb.

Today, attractive floors are one household luxury anyone can afford. Whether you do the work yourself or pay someone to do it for you, floor refinishing heads the list of inexpensive renovating and

modernizing jobs. If your present floors are old and of an inferior soft-wood variety that acratch easily and splinter under wear, there are three possible methods of improvement, They can be painted, they can be covered with artistic linoleum, or they can be replaced with new hardwood floors. In a colonial or cottage-type home, point is perhaps the least expensive solution. It is both attractive and long wearing. Coated with a waterproof paint or enamel in dark blue, gray, black, or green, even the most battle-scarred floors can be made to lend attractiveness and charm to modern as well as early-American surroundings.

Unlike most floor finishes, paint requires little surface preparation and has covering qualities that hide even the deepest bruises and the blackest spots. On old varnished or shellacked floors, simply remove the high gloss with sand paper, or by washing it with a weak solution of sal sods, and apply the paint. If the wood was stained originally, a new coat of thin shellac or aluminum paint will prevent troublesome "bleeding." In most cases, two or three coats of high-grade paint will

be found sufficient to complete the job.

Lately solid-color and inlaid linoleums also have gained popularity as a floor finish. Modern linoleums are sturdy and easily cleaned, requiring only an occasional coating of special wax to keep them tidy and in the best of condition. Manufactured in a wide variety of textures and colors, they form an attractive and oppropriate flooring for almost any room in any type house.

If new floors are desired, the home owner has such woods as oak, maple, beech, birch, ash, and yellow pine to choose from. For beauty and long life, quarter-sawed oak is, and always has been, in popular demand even though it is expensive. Rift-sawed yellow pine, on the other hand, besides being the cheapest, also offers good value for the money.

When a new floor is to be laid directly over the old, a rather thick stock should be used. This will prevent springing and supply strength to bridge any worn spots in the old surface. In most renovating jobs, the one-half- or five-righths-inch boards prove the most practical. As to width, either one- and one-half-inch or two- and one-quarter-inch can be used. The narrower board, of course, is the stronger and more attractive.

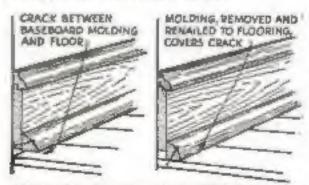


Illustration shows how floor molding can be removed and remailed in place to cover had crack

Carrol Int Indiana

In estimating the amount of lumber required to cover a specific area, it is important to allow an excess for waste and joints. In general practice, this amounts to fifty percent more than the actual floor area if one- and one-half-inch boards are used and about thirty-three percent for the two- and one-quarter-inch variety.

ONCE the old floor has been cleaned, dried, and covered with a good grade of waterproof paper, the new boards can be laid at right angles to the old. Start the first board by placing its groove to the wall after having removed the bottom balfround molding on the baseboard. Leave a one-half-inch space between the board and the base to allow for expansion and settling. The crack formed will be covered by the molding when it is nailed in place, Likewise, do not cut the boards too long; they need not be exact in length as the molding will conceal any irregularities.

For fastenings, sixpenny wire finishing nails or cement-coated nails can be used. These should be spaced not farther than sixteen inches apart and should be driven into the board at an angle of approximately fifty degrees just above the tongue. In high-grade work, a set can be used to drive the nails below the surface to provide a snug fit in the adjacent groove. If by any chance a tongue is spintered or broken by the hammer, it should be removed to allow the next board to fit tightly.

In finishing new hardwood floors and in refinishing old ones, the bome owner can lighten his work by taking advantage of certain new materials and methods. There was a time when floors had to be scraped by hand. Today, motor-driven sanders replace elbow grease. In almost every locality, powered sanders can be borrowed from hardware stores and paint shops. Rented for a few dollars a day, they come complete with wire brushes, and sanding and polishing attachments.

New bleachers and varnish removers also make refinishing floors a simpler problem. Applied with a brush like paint, they soften the old finish so it can be scraped off with a putty knife, and also in many cases they bleach the wood back to its

original beauty.

The best type of filler to use on a new or an old floor depends on the wood. Close-grained woods, such as osh, beech, birch, and maple, require no filler, white oak, an open grained wood, requires a paste filler. Finally, because it has a soft grain, yellow

pine requires a liquid filler.

Paste filler should be thinned with turpentine to a brushing consistency and applied by brushing it first across the grain with a stiff brush, allowing it to dry for about thirty minutes, and then removing the excess by wiping across the grain with clean burlap or excelsior. After twelve hours, the surface should be sanded lightly and wiped clean with a benzine-moistened cloth. Liquid filler is applied with a brush just as it comes from the can,

If THE final finish is to be varnish, apply it with a full brush across the grain and then brush it lightly with the grain. At least two coats should be applied with from forty-eight to seventy-two hours allowed between coats for drying. It is important in all (Continued on sage 9)

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HOW TO REPAIR FLOORS IN YOUR SPARE TIME

(Continued from page 7

varnish work that the room temperature be at least seventy degrees Fahrenheit

Sheliac, although applied in much the same manner, must be brushed on quickly to avoid marked overlaps. It dries faster than variesh and generally two coats appared two hours apart are sufficient.

A relatively new type of finish called the sea, froish, is gaining in popularity in both new and old work. Combining the action of both the filter and the outer finish, it penetrates the wood and seals the surface against dirt, grease, and moisture. It is applied with a lamb's-wool mop or a brush, the final cost being buffed with a pousher or electric polishing machine.

Not every floor-repair job calls for complete refinishing and polishing. In many cases, the home owner can improve the appearance of existing flooring merely by removing squeaks and hiding the telltake marks of normal settling. For instance, loose boards that invariably cause annoying squeaks generally can be stienced with a few wire nails. First find the loose end of the board that is causing the trouble. Then, drill two boles through the board at opposite angles. Finally, drive in the finishing nails and cover their beads with put, y.

In a similar way, a few minutes spent with a hammer and not set con remedy the unright y cracks that often develop between the baseboard molding and the flooring. In cases where these cracks occur, it will be found that the half-round molding at the bottom of the baseboard has been nated to the baseboard instead of the flooring. Simply loosen the molding strip, remove the nails, and renail it in place by sinking the nails into the floor boards. Any additional settling then will merely pull the baseboard away from the floor but the crack formed will be covered by the molding attached to the floor

Cracks also often develop between boards in a floor because of setting. If small, they can be fided with putty, but large openings abound be fided with wood

The cracks are cleaned by drawing a bevel-edged chisel along them. Theo from a one-half-such board saw a long strip, a trule wider than the crack, with a bevel on one edge. Spread glue on the bottom and square edge, leaving the beveled edge dry, and drive the strip into the crack. When the glue dries, the strip can be sanded or scraped flush with the floor-

IN CONCLUSION, a word about the care of floors will not be amiss. First of all, on any wood floor avoid the use of soop and water. Dust it with a floor mop and go over it occasionally with a rag or mop moistened with floor oil. As soon as the finish starts to show west, a new cost of finish should be applied before the damage becomes too great.

Remember, floors are sculled and scratched as is no other surface in the house. To keep them in first-class shape requires only a few minutes a month but to renew them, once they have reached the eyesore-stage, takes time and money





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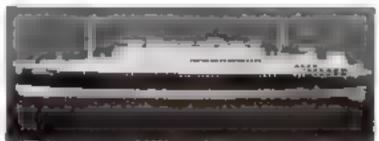
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In constructing pits of this type, you can save yourself much time and trouble by making use of our construction kits. These are divided into classes, as shown in the follow-

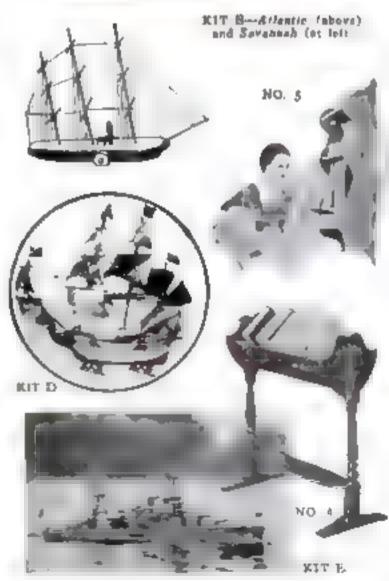
Our standard ship model kits have all been especially designed for Portlan Schwer Mostrilly by Capt. E. Armitage McCarn, tounder of the Ship Model Makers' Club. All the necessary raw materials are included, together with full-size blueprints and instructions. The models themselves, although not particularly hard to build, are of a very fine type, and the larger ones such as the Hartford and the Bounders are worth several hundred dollars each if carefully constructed.

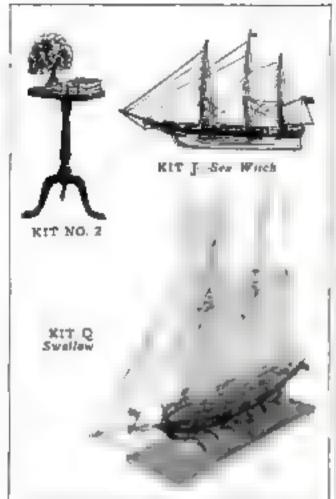
The easiest models to make are those designed by Theodore Gomms for the Pupular Science Model of the Month Club. They are beautiful little water-line models, made of baha wood. A unique layer-built method of construction is used, so that they can be put together with no other tools than a pockethmic, some runt blades, and a pair of phers. These kits contain all the raw materials, paints, blueprints, and instructions.

The simplified ship model kits form a third and intermediate classification. They are of the same general construction as our standard models, but are very much smaller and require much sest work. In these kits the hulls are furnished toughly shaped, and various finished and semi-finished parts are included.

In the case of our furniture kits, all the machine work has been completed, and the purts can be put together after a little hand finishing and fitting have been done. These are distinctive custom-built designs and are of superior quality throughout Only in the more expensive and exclusive furniture stores will you find their equal.







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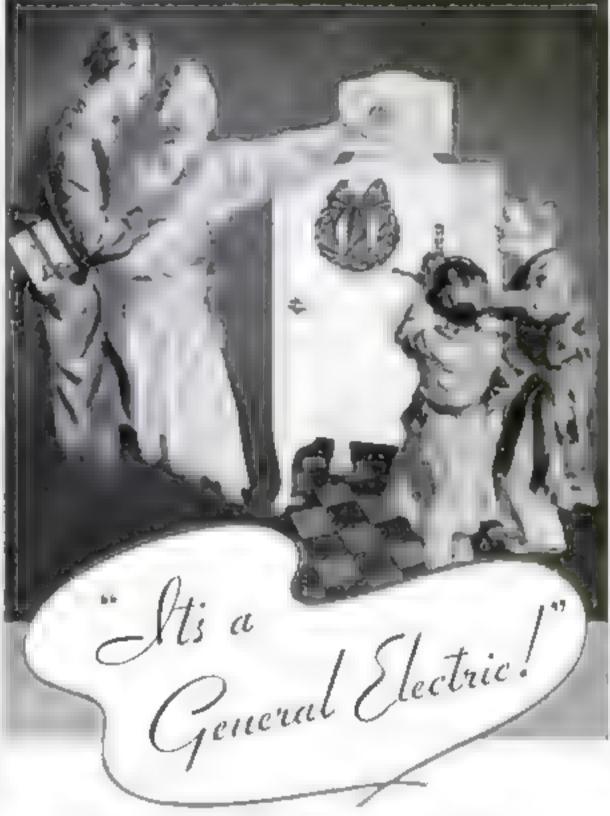
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Our Readers, Maybe the Eskimos Do Use

Electric Fans, After All

IN THE article Is Your Idea Worth Patent ing?" in the September mue, you have an it lustration based on the idea that it would be irrational to try to sell a sted to a South Sea Islander Quite true, but I would like to call to your attention the

interes ing but little known fact that the Hawatians (Polynesians, if not South Sea Islanders) enjoyed the slid og, centunes before Columbus was born This was the sport of lange. Instead of as ng a sled on ite or snow, they would side down grassy hi laides on



bunches of Ti leaves. The Ti is a monocotyledonous plant whose pithy branches terminate in good-sized hunches of two-foot leaves. Down is steep halaids, seated on slippery leaves on dry grass the Hawasans would glide fully as rapidly as if coasting on ice with steel runners.-F W H., Watalus, Oahu, T.H.

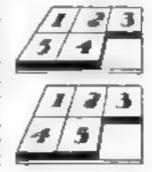
This Shell Game Is A Matter of Inertia

Tire problem of G.J., London England. about the 100 pound, assume projectile, can easily be explained by Newton's first law if you are in a pirpiane and are going at the name rate of speed as the projectile, the projecture in relation to the airpiane is at complete rest hou simply come up under it and let it rest in the passenger cockuit. From then on it will act just the same as any other 100-pound weight in the airpeanc's body or cargo, and when you bank and turn, it will have no more of a tendency to continue in its original course than any other similar weight would have in the circumstances under the law of intertia. The plane itself would have the same momentum, in proportion to its mass. The decept ve part of this problem is that we consider the projectile, because it is a projectile, as going at a terrific speed. We forget that the mass of the plane is subject to the same laws, -O.A.N., Perth Amboy, N. J.

A Place for Everything -But Try To Put It There!

I have a puzzle which seems difficult to me, and I wish you would publish it. Divide a piece of cardboard anio six squares as shown in the diagram and number the squares from

one to five. Cut out five pieces of cardboard and number them from one to five. Place these cards on the numbered squares, but in the order 1-2-3-5-4. The problem is to get all the cards on the squares of corresponding number. A card can be moved to a vacent square adjacent to it horizontally or



vertically, but not di-agonally I hope to see a solution soon in Our Readers Say, A.H., East Liverpool, Otoo.

Another Young Watchmaker is Heard From

Tax idea of GSG, Pittsfield, N. H., that you publish articles on watch and clock repairing, appeals to one. Although I am only fourtees years old, I have fixed many alarm clocks, mantel clocks, and watches. I put a mainspring in my seventeen-jewel watch and it worked fine. I find that the trouble in cleap clocks and warrhes is often in the balance wheel. If the tap at the end is adjusted and oxied, the timepiece will usually go again Repairing clocks and watches is a fascinal ng hobby and one at which the skillful amateur can save himself a considerable amount of money usually spent for minor repairs. A series of articles on this subject would be appreciated.- k.N.P., Ashtand, Va.

He Must Have Met a Road Hog the Day He Wrote This

ON PAGE 21 of your October twose I see a very poule little gauget for automobiles, that finshes "Thank you." fore and aft when the dashboard control is worked. That is fine With knee action cars, it pught to be possible to drop a curtist too But that attle device would be completely tongue-fied out here where men are men and motorats are eloquent. It just have a got the vocabulary. Alsumme that you do want to say. Thank you" sometimes, what are you going to do on those more frequent occasions when the only fitting

remark is Where the herk do you think you're going?" or Who told you that you could drive a car?"? Of course, you could have a panel with a wide selection of remarks, and a row of busters to illumi nate the one that teems appropriate. The best thing I we seen so far,



though, is the little rubber thing you nut on the exhaust. When you pull the strong it gives a perfect rendstion of that understand noise variously known as the bird, Brook cheek and razzberry. In my experience, this covers about ninely per cent of the demands for interdriver communication.—B A H., Reno, Nev

The Bee Controversy Ends ---With a Sting, of Course

THANKS, E.C.B., Sioux City, Iowa, for admitting, in the September issoe, that you were mistaken when you stated that worker bees "have no sex and are neither male nor female." And, although you at first called me dumb," thanks for admitting that I was right when I corrected your statement. Your only claim now is that you have "a perfect right to call a worker bee a nepter if you feel like it." Certainly, you have a perfect right to call it a nester, or a bumble-bee, or a hornet, or anything else, if you feel like it, but that does not make it anything but a female worker bee. Every reference you gave that mentions the word "neuter" states that, no matter what you call them, worker bees are females. Yes,

E.C.B., now that you have learned what a worker bee really is, regardless of what you call it, let's quit.-C H P . Cansan, Conn.

But Why Shoot at the Engineer, Anyway?

Hear is a grablem I would like some of your brilliant readers to solve. Two men are at opposite ends of a freight train, which is

going filty miles an caboose shoots at the man in the engine and the buset travels exnetly 6/19 mum an hour and Would the bullet ever bit the man in the engine? The more I think of it the harder it gets, so I hope someone answers it with proof This



ought to be a pushover for some of your mathematically minded readers - B.H., Georgetown, Ky-

E.A.T.'s Green Dots Are Identified as Chlorophyceae

THE letter of E.A.T., Charlotte, N. C. Mairs that he decovered under his microscope a colo + of blue-green dots held together by protoplasm. I believe that what he saw was the volvoz, or colonial green algae, which may be found in aquariums. Volvox is a colonial form consisting of many cells embedded in a jellylike substance. This seems to answer E. AT's description of the objects he saw, and the water he was examining came from an indoor aquarium, according to his report. They may develop to the size of pinheads and rol. through the water like a porcelain platter For further information he might look in any botany book under the heading of Chlorophyceas or green algae, H.B.P., San Francisco,

A Friend of Morpheus Bans Synthetic Slumber

As cost of your most faithful readers, I wish to protest against the suggestion made by R.P.B., Baltimore, Md., in the October lieue He wants the scientists to go to work and discover a substitute for sleep, so that we can stay up all night and watch divilization advance. I'm not exactly a cyme, but I believe that the world would be a better place if most people slept eighteen hours a day instead of

eight. You never heard of anybody getting into trouble while he was asteep. Science is all right in its place, but when it goes to giving us tablood food, canned music and voluntary stisomitian it's all wet. I like my sleep, and the only thing that can keep me from getting it is a new issue of POPULAR



SCHEECE MONTHLY, I suggest that R.P.B. hang around a night club for a while and see how fast civilization advances around two o'clock in the morning.—B.E.D., Daveuport, Lows.

Now For a Little Fan With a Frustum

I am submitting two problems that may be of interest to your readers. First, to find the

length of a conical helix or tapered apiral impressed (wound) around a frustum of the dimensions given below Consider the helix as having no diameter, as a line has no width. The lead, or distance between turns of the helix, measured along the slam height, is ten unches, the vertical height of the frustum is jorty



eight inches, diameter of larger base, twenty-four inches. The hear extends between the two bases becond, a problem in physics. A cube of steel one inch on the edge is taken with initial temperature of zero degrees Fahrenheit and put into a furnace or heating oven whose temperature is 600 degrees Fahrenheit. What length of time is required to heat the cube throughout to the same temperature as the heating oven?—E.A., Sault Sainte Mane, Mich.

An Inveterate Cut-up Supports the Dissection Movement

I acress with M.G., New York City, about the amateur dissection department. I have cut up all sorts of creatures from the flex to the horse since I was fourteen years old, and of course I have quite a bit of data on autoputes and year morrom examinations of amount Another request I would make is that you publish plans for constructing X-ray and high-frequency mechanis. This apparatus would be a great aid to me in my work on animals—I J.H., Detroit, Mich.

They Have Rainbows at Night in Hawaii, Too

I was interested in the account given by G.S., Sydney, Amstrain, of the rumbow he saw at night. I came to the Hawman Islands in 1923 and soon heard about the nocturnal rumbows which are quite common in the valleys near Honolulu.—E.M.J., Honolulu, T.H.

A Department To Advise Puzzled Inventors

As an improvement to your masarine why not open a "What To Invent describent? Things of this kind are already being published, but they are gotten up by people who have no connection with real technical and industrial problems. Therefore, I suggest that you write letters to various industrial companies—chemical, mechanical, railroad, electrical, automobile, shipbuilding, war supply, and so forth—asking them to give you any problems concerning improvements and new inventions needed in their special fields. The

amount should be by no means brief or popular, but very exact and technical, providing information as to what has already been done in the same line. You would publish these facts for the information of inventors. I am personally interested in such articles because I am a civil engineer with an inventive turn of mind,



unemployed at present on account of the depresson.-V.E.H., Los Angeles, Calif.

Apparently Darwin Never Thought of This

Ix means to evolution, I think that a good argument against it is chemistry. Take, for instance, water, H₂O. It has been here since a long time before man, and it has not changed. Neither have any of the ninety-two original elements. They combine in fixed, unchanging proportions. I do not believe that it can be shown that anything else has changed materially, either —L.S.B., Fullerton, Cahi

This Would Make Us Angels, One Way or Another

I mave beard of people raising themselves as high as ten feet in the air on birdlike wings and others, as a sport on the seasbore, jumping as high as fifteen or more feet with the aid of spherical baildons. I wonder why no one has thought of combining these two ideas by devising an outfit which would include a pair of wings, made of canvas stretched on a light-weight frame of proper size and proportions, together with a halloon of the dirigible type, of such dimensions that it would suspend a weight about half that of a man This agrestat could be divided into three or four compartments to offer greater assurance of sufety. The wings could be attached to the man's arms so so to be swang by the same motion as a bird's, while the dirigible, attached by straps from above, would give a certain amount of buoyancy. The man's hody would preferably be in a horizontal position

in the sir The wings would have a concave shape underneath and consist of two leaves, divided longitudinally and hinged in the mostic so that when swing upwards they would fold, and when swing down ward they would open and be held in that position by a calcher at the hinges. This movement would make the neces-



sary resutance through the air to raise the man almost vertically and propel him through space. Direction could be controlled by twest ing the arms and hands. The less might be equipped with flaps, if this were found necessary to teamtain equilibrium. Such a method of flying would possess many advantages over present-day gliders. It would make it possible in zo up in the air will out, uniging from a billtop or being trailed by an airplane. In strong winds, the balloon would prevent false currents from dashing the operator to earth. It tould land almost anywhere. Speed would not be great, because of the resistance offered by the balloon, but this would be compensated by the greater safety. Other essential features I will leave to the experimenters to discover--- J B L., Suo Paulo, Brazil

Inventor Suggests Wiring Jails for Sound

Yet often hear of criminals getting out of jan by sawing through the bars but I have an inea that I could build a jad that nobody could get out of I would make he hars of the cells hollow and run an electric wire through each. There would be a panel in the main effice with a neb for every cell in the jan. Sawing a bar would flash the light conresponding to the cell, of time a bell and an officer could go my a to the place where the escape was being attempted. You could even have weres in pipes all through the wade of the building. Then a prisoner could not get out either through the made or through the doors or windows. What do you think of the idea? A friend of mine suggested putting in honow bars with rollers made so that a new e und not get a grip. The trouble with this is that the prisoners would soon get onto the trick of horing a hose through the hollow bar and putting in a pun to keep it from imming.

—J.H.J., Kansas City, Mo.

Never Start on Argument With a Stamp Collector

I smorth like to ask G.D., of Jamaica, N.Y., a few questions which came to me after

reading his reply to my letter in Our Resders Say Would he advise a person not to collect stamps just because he could not tell a lake stamp from a genuino one? Does he think that every stamp collector has to be a chemist? How many collectors are there in this country who use themicals (other than bennine to



the watermarks) to tell a true stamp from a fake? I am sure that most collectors would answer "No" to the first two questions and No many" to the third. I hope you will publish this letter so that readers of Our Readers Say won't think that they have to study chemistry before taking up the greatest hobby in the world, stamp collecting.—F.H.S., Bangor, Mr.

J.B.K. Should Have Steetched His Imagination, Too

ANSWERDER the question of FB K., Bellefont, Kans., relative to the space between the earth and a wire which was originally equal in sough to the discumference of the earth and to which 100 feet of wire has been added. The answer depends on the simple mathematical relationship between circumference and diameter. Consequently, 100 feet added to the wire must result in a new circle 100 feet greater in curcumference and therefore 31.8 feet greater in diameter or 15.9 feet greater in radius. An old Irick in mathematics matruction was to present the problem as stated by JBK, and then ask, "If we now take a hall one foot in diameter and stretch a wire around if, then add 100 feet to the wire and again stretch it so that there is the same space all around, would the space be greater or less than in the first example?" While the contrast is confusing at first thought, the answer is obviously that 100 feet added to any curcumference results in the same amount of dicrease its the diameter and consequently in the radius, which affects the distance from the original circle in the problem given.-G.A., Brooklyn, N Y

Try This Crystal in Your Microscope

I may a microscope and my specialty is crystals. Here is a good formula for a beautful crystal a pinch of Epsom salts and a drop of bone and frequid. It's worth looking at 11 M., Peru, Ind.

And the Grass Is Barely Up After the Goat Problem

By thus time, I am sure, CCB, of Los Angeles, Calif., has been told where the socalled "extra square inch" came from The

area be was to anxiots to find is just plain open apace. Now let kint answer one. A cow is tied to the fence of a circular field containing an area of exactly five acres, by a length of rope sufficient to allow her to grame over one acre. How long is the rope? My diagram 2.



lustrates the problem, which ought to give a little extertainment to your pasturage experts, —J B.B., Alexandra, Va.

How science measures

"Auto-Fatigue"

By ANDREW H. RYAN, M. D.

Dr. A. H. Ryan, well-known authority, tells you here exactly how he measured

the effects of "auto-fatigue" on the human body during motoring, and the astounding facts he discovered.

It is a well-known fact that chousands and thousands of motors to suffer from 'surofatigue.' That is, long, hard drives, covering great mileage, or city driving with its difficult traffic conditions, often produce physical and nervous exhaustion.

"In my laboratory at Chicago, we determined to make a sound, scientific study of the nature and extent of this exhaustion, and to find out how it might be overcome, if possible.

"First, I developed or adapted a number of appeal instruments, all highly delicate is nature, to make these experiments.

"As subjects, I chose several carefully picked college men, and put them through a series of experiments extending over several weeks. Each driver received the same tests under practically the same conditions.

"Records were taken every morning before the driving started, then the men set out in a body, using different makes of cars, for 200 to 400-mile trips. Records were kept at varying intervals during the drive, and a complete comparison made at the conclusion.

"Thus, after a man had driven 400-miles,

we could check accurately how much fatigue and exhaustion he suffered, in contrast to his condition at the beginning of the day

"Figures for each make of car were kept, and I was interested to note that the drivers on the Dodge car showed 54 % to 65 % less nervous and muscular impairment due to fatigue, than drivers on other cars tested."

Easy On Your Pocketbook, Too!

The sensational engineering advancements that give the big Dodge its easier riding qualities, have an important bearing on economy, too. Vibration—the enemy that is alowly, attaidly shaking ordinary cars to pieces—is smothered, so Dodge lasts longer. You don't have to pay out money for the repair bills that constant vibration causes, either.

Remember, the name Dodge on the cor you buy means that it is backed up by nearly 20 years experience in building nearly three miltion fine vehicles. Engineering genus is matched by manufacturing genus? The result is reflected in important operating economies. For example, Dodge owners report 17 to 22

miles on a guilon of gas. Hydraulic brakes are not only self-equalizing—for sufe, smooth stops without awarving—they also save both tires and brake limings. Valve seat inserts save gas, postpone valve granding for thousands of extra miles. Dodge is so well and exceluby built that it is bound to save you money, be a better investment for you.

Dodge Advantages

The astronding results of Dr. Ryan's tests are due to basic and radical advantages in Dodge engineering—to dotens of special comfort features that make riding camer. By a remarkable invention known as Floating Power-engine mountage, wheation in a Dodge is completely smothered. Then, too, Dodge ut likes rubber at 56 vital points—protection against road shock, none, bumps, and rough riding.

The Dodge type of independent front-wheel suspension in also a means of increasing comfort.

The easy action of hydraunc brakes assures cases, amonther operation—less fatigue.

Make This Test Yourself

Go to any Dodge dealer and ask for a free copy of the booklet describing Dr. Ryan's tests. Drive a Dodge. See for yourself that Dodge is easier to drive, that it is camer on your nerves, that it gives an entirely new kind of comfort. Dodge Bruthers Corporation, Division of Chrysler Motors,



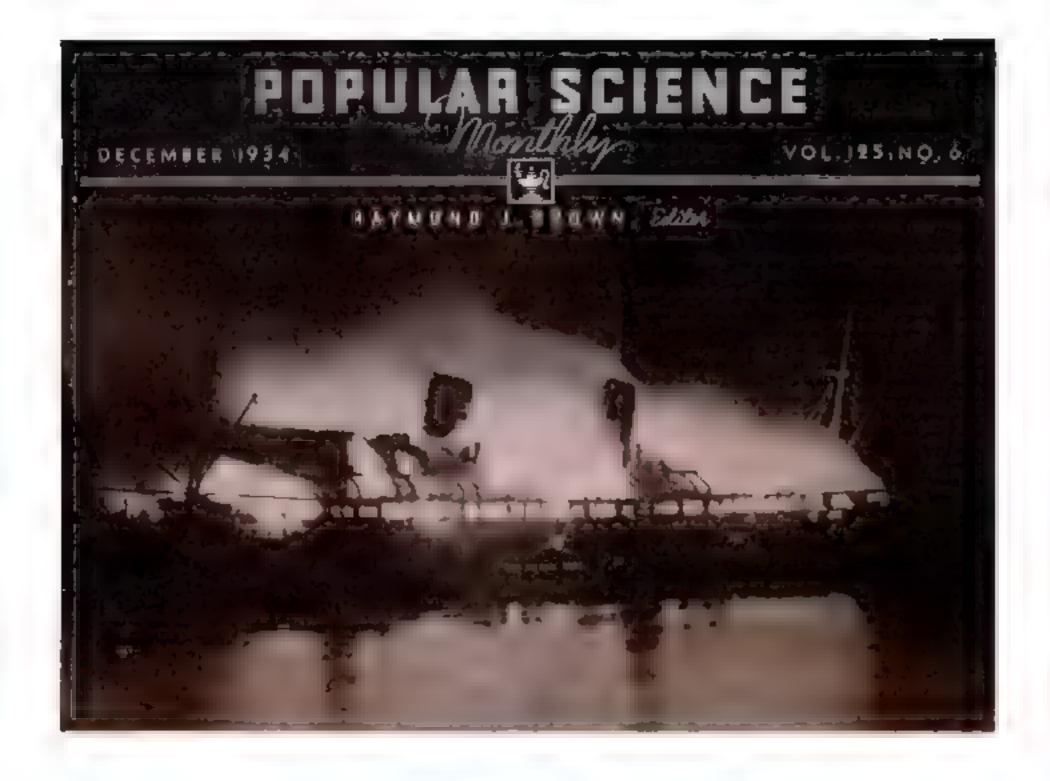
POSTURAL STEADINESS TEST—This sensitive instrument passures the amount of body away (a sign of farigue). Measurements were taken before and after the long test drives.



HAND BYE COORDINATION TEST tomsures the impairment to manual and visual stendings, and effects on the coordination of hand and eye, resulting from driving fatigue



VASCULAR SEIN REACTION TEST—This literument records the reaction of the blood transis of the skin to a tired nerve condition. Tests were made before and after the long drive.



FIRE at SEA A Challenge to Science

LAMES which turned the insurous liner Morro Castle, into a pular of fire off the New Jersey coast, a few weeks ago, have lighted up once more the age-old problem of fighting fires on the sea. With more than 100 persons dead in this greatest of recent marine disasters, people all over the world are asking: Can such tragedies be ended? Can completely fireproof ships be built? Can such the bring safety to the sea?

In search for the answers to these universal queries, I have talked with steamship officials, with naval architects, and with fire prevention experts. They have told me what they have done and what they plan to do. They have showed me innovations and ingenious mechanisms which they hope will go far to eliminate the human element and automatically throttle fires before they can spread.

In recent years, crack new liners, designed by able naval architects according to rigid Government specifications and built in the best shippards in the world, have been victims of fire. The French giant, L'Atlantique, burned in the English Channel last year, a \$20,000,000 loss.

Twelve months before, another ace ship of the French merchant marme, By JOHN E.

the George Philippor, was gutted by fire in the Gulf of Aden. About the same time, the Bienville, pride of the Southern Pacific fleet, burned at New Orleans, La., with a mi Lon-dollar loss. The North German Lloyd liner, Muenchen, was destroyed by flames in New York Harbot; the Segovia went up in smoke at the pier of her builders in Newport News, Va., and the palatial British motorship, the Bermuda, burned in the harbot of Belfast, Ireland.

At exactly the time the Morro Castle was becoming a floating torch, seven miles from shore, the Grace liner, Souto Rits, was racing up the Pacific for Baibon, Canal Zone, with a fire in her hold. From Calcutta, India, from Honora a, Hawari, from Scattle, Washington, have come reports in recent years of burning liners. This trail of maritime disasters encircling the globe is a challenge to science

Is this the best you can do?

The answer is: No

Before we see why the answer is justified, let's run back for a moment over the progress that has been made. Take a single example from the annals of the sea.

LODGE It is a bright May morning on the North Atlantic. The Royal Star

freighter, St. George, is ramming her bow into crisp and foam-streaked hillows. Her hold is packed with

cotton bales and bags of castor beans.

On the bridge, the officer of the watch balances himself on heels and toes to the lift and fall of the heavily laden ship. His gaze wanders from two sallors spticing hemp cable on the forward deck to the tall hoosed ventrator leading to Number One cargo hold. Instantly be snaps to attention, Curling thinly from the ventilator cowl, then coming more thickly, dark and omingus, is smoke!

He cours through cupped bands: "Forward on deck! Swing Number One ventilators out of the wind! Lash turpaulins over them! Make it lively!"

The sailors are on the jump. He summons the Captain, turns out the off-watch, orders the fire-pumps started, runs out the hose, and relieved of his watch, goes below to investigate. He cautiously opens a door to Number One hold and then slams it shut again in the face of rushing smoke and fiame. The ventilators are still forcing air into the hold where fifty tons of cotton are ablase.

The men try fighting the fire with steam jets. The vapor seems to help the blase. They decide to flood the hold. Hour after hour, the pumps pour sait water into Number One. But the walls and deck grow botter. The ention in Number Two hold catches fire. Then Number Three, packed with only beans, begins to burn. The deck planking is curling and smoking. Spurts of dame pour from the hatches, the ports, and lastly, from between the buckling plates of the ship's structure.

The vessel is hove to. It rolls from side to side far down by the bend, loaded with tops of water



This serial view of the Morro Castle shows her blading from stem to stem



Here is a typical cargo protecting system. In these cylinders is stored the carbon diameds which, released into a framing hold, will amother the flames without damaging the cargo.

For forty-eight bours, the men battle the flames. Boats are slung overside. Finally, with a cracking roar, a steel batch cover collapses into a bold. From the opening, a pillar of smoke shoots skyward, streaked with sparks and flame. The battle is lost; the ship is doomed.

On the bridge, the Captain, burned and choking, gropes for the whistle-pull. The mournful blasts of "Abandon Ship" sound over the empty sea. Boats slide rapidly down into the water. The crew pulls to a safe distance and then waits to watch the end. The column of smoke rising above the funeral pyre of their ship, they hope, will bring a rescuer

That is the story, repeated a hundred times, of fire at aca before the days of the radio and improved equipment. No matter how alert the crew might be, if fire began the odds were overwhelmingly against them

In contrast, consider the experience of the Santa Rita. With sixty-six passengers abourd, this twin-screw, oil-burning liner was beading up the Pacific, 200 miles from Balbus, Canal Zone, early on the morning of September 9. Fire broke out in Hold Number Three. Immediately, emergency tanks of carbon dioxide, the colorless, heavy gas that puts the fixt in soda water, began pouring their contents into the hold. The gas settled toward the floor, formed a blanket of vapor over the burning material and kept the oxygen away. The flames died to a sullen glow and remained in this condition until the vessel docked at Balbon. Here tharine firemen boarded her and extinguished the last of the blass. None of the passengers had been in danger and the damage to the ship was night.

Had the St. George carried this modern gift of science, ber fire could have been held in check with equal ease. Linear now under construction will not only carry carbon dioxide but will have an angenious network of inter-connecting pipes incorporated in their structures. Through these pipes, compressed carbon dioxide can be shot to any part of the vessel at a moment's notice.

Lake nerves running from all parts of the body to the brain, these pipes will lead from all over the ship to a tiny room set on the bridge near the chart house. Hardly six feet square, such fire beadquarters, in their simplest form, will contain three large, glass-fronted cabinets packed with numbered lights, annunciator flaps and flat nozzles. Around them and on the walls will be gongs of all sizes and times, push-buttons, switches, telephones, and plans of the ship's



With this portable carbon-diaxide extinguisher, a small blaze can be fought. Note, the cloud of heavy gas

fire system with every protective device indicated.

Every boar of every day, whether the slap is in port of at sea, a trained fire guard will be on duty in this tiny compartment. All notifications of fire, whether automatic, vocal, or manual, will come here to be translated by the guard into split-second action.

Imagine, for instance, that a fire breaks out in the hold. The fire guard is stiting before his bettery of nozzles and gongs reading a magazine. Suddenly, he lays it down and smills suspiciously. A faint acrid odor is increasing in the air. Glancing quickly at the cabinet containing the rows of flat, vertical nozzles, he sees smoke rising from one of them. The brass lag on

Instantly, the guard flashes word to the officer in charge of a battery of carbon-dioxide cylinders stored near the upper part of the engine room. Standing in long rows, like the pickets of a fence, these cylinders, often as many as 100, are connected to a manifold with valved branches leading to all the bolds. Every opening to Number 4 is quickly closed. Then the officer opens a valve and carbon-dioxide under 1,500 pounds pressure rushes into the compartment. Flooding the bold, it chokes out

the fire without damaging any of the goods which remain unburned.

When the officer opens the valve, he automatically cuts off the upper part of the pipe leading from Number 4 to the fire headquarters. This arrangement makes it possible to use tho same pipes for the smoke alarms and the gas. The detector system at the cabinet continues to function for all other parts of the vessel while the fire is fought at one point. Fans, producing a continuous draft, draw air up the alarm papes, thus bringing smoke to the lookout at the first menace of flames.

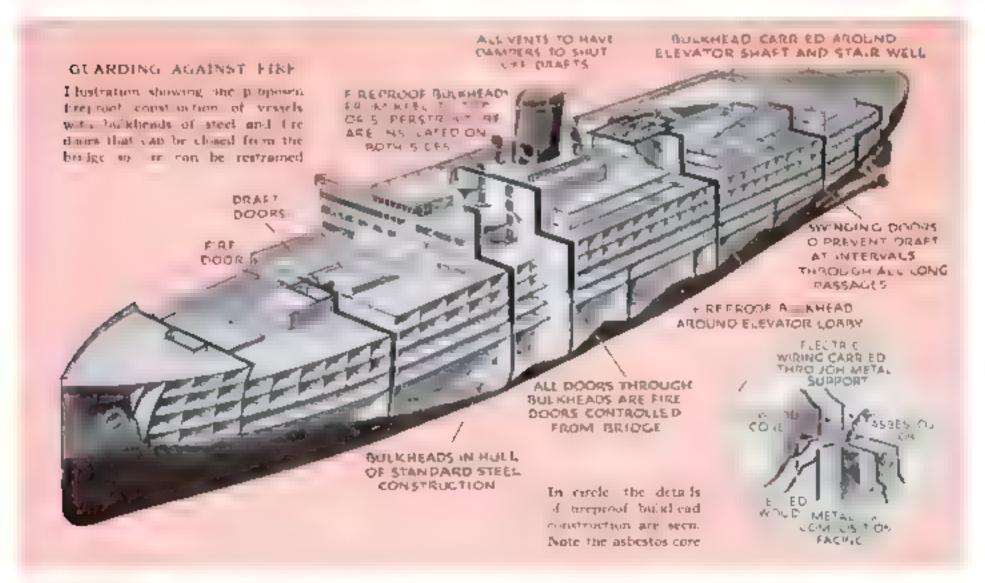
Not long ago, the Alaskan steamer, Alameda, nosed her way into the harbor at Scattle, Wash., loaded with copper. A short circuit started a blaze. The fire gained headway and strange lavender flames coveraged the super-structure. They came from the copper one in the hold. Fireboats pulled alongside and fought the blaze. It was a losing battle. With acetylene torches, firemen cut their way through metal plates to rescue two trapped sailors. Finally, with hope of saving the vessel gone, tugs towed it out into the harbor away from other craft and let it burn. When the flames died down, a \$600,000 ship had gone up in smoke. Only the warped and blastered bull remained. Rapid-fire use of a carbon-dioxide safety system probably would have saved the vessel.

In the case of the Morro Cartle, alarm tubes had been installed running to the bridge. But, because they brought an odor of hides from a bold, according to testimony given at the investigation, the captain had ordered them stopped up.

Thus, removing the human element from ship alarm systems is a major problem. It is the weak link which science is seeking to eliminate. By means of automatic mechanisms and light-sensitive metals and ingenious robots of the laboratory, experts are now blazing a trail toward systems independent of human action,

ONE group of research men, for example has been experimenting with photo-electric cells, magic eyes which react instantly to any variation in the amount of light striking them. When smoke begins to pour from one of the noszles, it cuts off a beam of aight projected across the opening upon the cell and sounds an alarm.

Another adaptation of the alarm pipes makes it practically impossible to ignore the signals although they are entirely when. If smoke issues from any of the openings, a light trained upward from within cellects from the particles and produces a striking display. A phosphorescent fountain seems to light up the wheelhouse. The quattermaster cannot overlook it and even the officer of the watch on the (Continued on page 128)





Lettent Boger prints are demanaged by dust and fares had may have been touched by the gu ty person

BOONE

HOUR before daybreak one morning a pale-faced young hurgain gancer furtively ap and down Wilshing sure he was anouserved, he huried a brick through the wandow of a store. Quickly he stepped in and helped himself to tweive machine guns and automatic pistols.

Soon the narm sounded, Patrolmen in radio-equipped autumobiles kept a silent lookout for all auspicious characters. Officer M. G Goskeil arrived at the scene He surveyed the wreckage and set to work with his magnifying glass and magic powders. The interior of the store yielded no clues. Then the officer turned to the latter of broken glass. For an hour be studied the shattered pieces, carefully dusting gray powder over the surface of each with a camel's-hair brush.

Finally the dim ridges of a single print appeared. Did it belong to the crimical or to some passer-by who had pressed a hand against the glass while peering in all goods on display? From its position and size officers quickly deduced that the print had been impressed by a right thumb—that the burglar, in his baste, had pulled out a splinter of glass which his smashing blow had failed to dislodge.

The scene shifts to a queet room of the Division of Record and Ideal heating and of the Los Ange es Police Department Holding in his left hand a photograph of the lone print, Captain Howard Barlow bends over a card-filled file comparing it with right-thimb prints of known criminals. He finds a duplicate? The impression on the glass belongs to a man already twice imprisoned for serious violations of law

Hardly had detectives, armed with photographs of the criminal, commenced their cessiully identified and the exist the Material through duplication of the first seas it is called for instance, own. Each decidental pocket accidental are Captain Ba of patterns or the captain of the

tain Barlow evolved a simple system of classifying "lone wolf" prints he started a file which today contains 50,000 individual priots from 10,000 known burgiars, tobbers, marderers, kidnapers, receivers of stolen property and thieves. These prints have brought about the accest of 1,300 persons wanted for crimes ranging from dynamicing to marder and have writing confessions from or convicted 1,235.

The single finger-print file now provides a means whereby a chance impression from the scene of a crime may be successfully identified. Identification of its owner depends upon legislity of the print and the existence of a duplicate in the ble Material for the file is obtained through duplicate copies of finger prints.

The first segregation in the Single File, as it is called, is by fingers. Each thumb, for instance, has a compartment all its own. Each digit is further divided according to pattern, such as loop, where central pocket, lateral pocket, twin loop, accidental arch, and tented arch.

Captain Barlow has reduced the scores of patterns ordinarily used by finger-print a speris to twenty-seven representing the whorls and more complex types. Finger-print systems generally are based on two peculiarities of indges which appear on the outer joint of the fingers, first, they form into various patterns, second fixed points, known as cores and deltas, are furned bance all finger-print experts are familiar

Capt. Howard Barlow of the Los Angeles. Police. Department above how a photograph to made of a finger print. The camera a held in actual two test with ourface.

A finger print on the handle of this double boder lad to the a test of a burglar-who had used the part to break a window. A during powder brought use the felltale print



search when a patrolman surprised a burglar in a downtown store. Searchers comparing his prints with those of "wanted" outlaws, found that his right thumb tallied with that of the machine-gun burglar Confronted with this evidence he conlessed and led officers to the stolen weap-

Such dramas are being written daily by Los Angeles police officers through positive identifications in the form of single finger prints. When, ten years ago, Capwith plain loop patterns, Captain Barlow found it necessary to evolve a master chart showing only a few whoms, loops and arches to guide his men in tracking down prints.

We found that prints from scenes of crimes were generally incomplete and indistinct," Captain Barlow told me. "In setting up a system of identifying single impressions we had to consider that portion of the finger which we could use to best advantage in classifying it, so we

Trap Master Criminals

confined ourselves to the cores and deltas found on the under side of the nail joint. From that small area alone we evolved our class fication."

Lone prints, often invisible until powder throws them in relief, are left behind by many criminals—on the face of a filing cabinet, handle of a cooking pot, the rear-view mirror of an automobile, on a gun barrel, bottle, surface of a door, the edge of a window screen. From every conceivable surface they are reproduced by cameras and brought to the single finger-print file

When a print is found, skilled officers immediately determine from which finger it originated. This is sometimes difficult yet a simple formula, quickly applied,

usually answers the question.

First, the position is considered. If very small, its size further indicates it to be a little finger. The slope of the ridges affords additional proof, for certain patterns, Captain Barlow has found, are unusual in particular fingers. Often two prints will be found close together, the relative positions indicating which fingers made them. For instance, the index hoger will be shorfer than the middle.

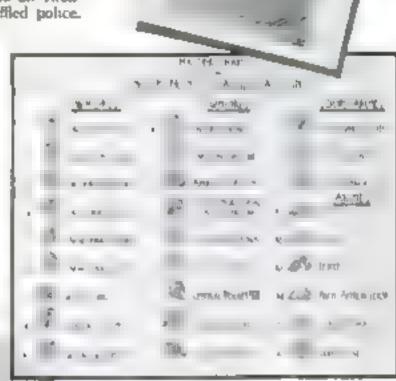
Identifications and convictions in single crimes are not ful measures of the value of the single-finger system, for often identrication of a single finger print has led to the clearing up of other crimes

An epidemic of office burglaries recently swept over Los Angeles. In each the burglar climbed over the transom, broke down the metal support of the transom, wrecked cabinet drawers and took nothing but money. The culprit work gloves and left no telltale prints behind.

Finally he slipped. On the front of a green cabinet drawer an officer found a

print. Quickly he dusted it, photographed it and carried the negative back to police headquarters. An hour later a searcher started his hunt through the files of index fingers. In a few minutes he found an identical print, taken some months ear ier from a safe-cracker in custody. A few hours later detectives brought in the suspect. Meanwhite search revealed that twenty-one offices had been similarly robbed. When confronted with this evidence, the burglar confessed to all twenty-one of the crimes that haffled police.

Though to untrained eyes one single finger print looks like any other, to the officers who see them daily, they take on definite personalities. Recently a burglar robbing a store left a thumb print on a small can containing money. When Captain Barlow examined the print under a magnifying glass, & criminal's name flashed into his mind. He went to the files, took out the print filed under that name and found them to be identical. He telephoned the



This matter chair guides afficers in classifying the thousands of prints on file. At top, an unusual print with its descriptive symbols

Lad-C-13

detective bureau, saying. Loren Harris did that 100

Impossible exclaimed the astonished detective. "He s in jail. I took him there myself last week."

When they checked with the jail, the detectives learned the culput had escaped the day before. A few hours later, when arrested and confronted with his print, he confessed.

The success of the single finger print system depends upon matching prints found at the scene of the crime with those of known suspects, whose prints may be taken by investigating officers, or with those of known criminass whose prints are in the voluminous files, Identificultion may not come in a day, nor a year; but if the criminal whose careiessness left the greasy ridges behind is so unfortunate as to be arrested anywhere in the United States, his prints may eventually reach this quiet little room in the Los Angeles City Hall, where searchers soon will link him with the particular दशासाह.

A bandit forced his way into a Los Angeles home, locked the husband in a closet, robbed the mother and killed the sen. An hour later Captam Barlow commenced his exploration of the room. With his black and gray powders he dusted every possible (Continued on page 124)





Left, the files that contain records of \$0,000 single forger prints. Officers are comparing prints left by or minals with the recorded prints which have similar qualities.

CHAINS BRAKE LINER AT LAUNCHING



ELECTRIC EYE DETECTS LIGHTNING ON ANTENNA

LIGHTAING he longer plays pranks at WLW, Cincinnati, Ohio, superpower broadcasting station, where it formerly interrupted programs by striking the steel antenna tower and leaping a safety gap at its base, Once started, the are was fed by the 500,000-wait transmitter and continued, draining the station's own power from the antenna into the ground. Now an electric eye cuts off power when an are occurs.

Left indicate action to into an away the new Br is his a to new Queen Mary plinging it is the River C vide on a since are leaded the holicas in we see the ways and he stated in he as much of dust

Below, drawing shows a relief fraction state by he can ow state in will be the impresse years' was laury hed

IN LAUNCHING the 1,018-foot superlinet Ouzen Mary in a space barely linge enough to float her mammoth hull on the River Clyde in Scotland, engineers recently carried out a feat unique in shipbuilding annals. To accomplish it, they attached eighteen enormous drag chains to the sides of the vessel, to check its momentum as it entered the water. So well

had the resistance of the chains been calculated that the great hull came almost immediately to rest, and was guided by tugs into the basin where its construction will be completed.

MOTOR WORKSHOP FITS SMALL SPACE



Left, the motorized workshop in use. It is equipped to turn brass and alum num, saw wood, drill both metal and wood, and perform roany other workshop operations

Below, drilling noft metal. The various attachments for the compact outfit are madely strached or detached as desired

So compact that it can be stowed away in a bex a foot square and a little over a yard long, a recently developed motor-driven workshop for the home is designed to do all sorts of operations in wood and the softer metals. The numerous attachments for the outfit are quickly attached by means of rapid-locking clamps and are removed as readily. Additional attachments

may be built with the outfit itself.



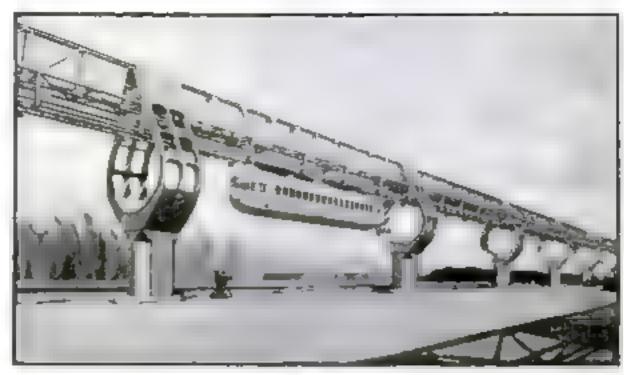
MACHINE TESTS PILOTS FOR QUICK THINKING

To tear the ability of airplane pilots, an unusual machine has been constructed at the U. 5. Bureau of Standards. The pilot ats at a set of regulation airplane controls, facing a panel upon which colored lights are flashed. Each combination of lights represents a certain flying pituation. The subject's twofold task in to interpret the meaning of the light signal and then to operate the controls as would be required in actual flight, while an automatic chronograph meanwhile records his reactions,

PEEP-HOLE SURF BOARD

WITH an ingenious "peep-hole" surf board, Sata Monica, Calif., lifeguards find lost yacht anchors and objects lost by bothers. A well in the board, covered at top and bottom with plate glass, permits a view of the ocean bottom.

AIR TRAMS MAY SOLVE BRIDGE PROBLEM



Cans speeding through the air at 100 miles an hour are offered by Joseph B. Strauss, chief engineer of the Golden Gate Bridge, as a solution of the San Francisco traffic problems likely to arise from the construction of the Golden Gate and Bay bridges. The aerial cars, as shown in the

design above, would be suspended from multi-wheel trucks running on a overhead track. The track would be supported by a single row of columns formed in loops at the top to permit the passage of cars. The construction would give perfect safety, the designer claims.

FAST CAMERA REVEALS HOW BIRDS FLY

THE secret of a bird's obility to gain altitude rapruly was revealed recently by a high-speed photograph of a mauming dove snapped with an exposure of one fifty-thousanuth of a second Operated by engineers of the Massachusetts Institute of Technology, the lightning-fast camera caught the dove just at the moment of take-off, and

showed that on the rapid downstroke of the bird's swing both the primary and secondary feathers overlapped, preventing the

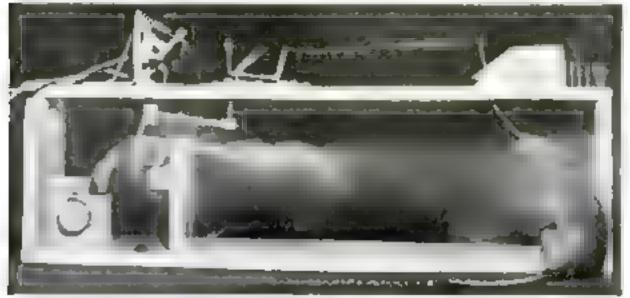


passage of air through the wing so that the berd can exert maximum lifting power. On the upstroke they let the air pass through.

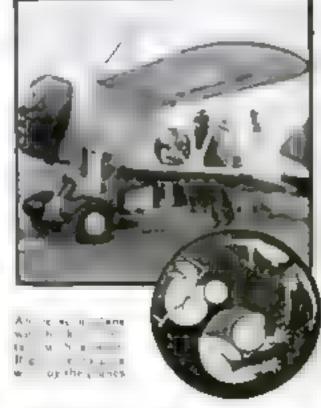
TRAP SHOOTS RAT AND TAKES PICTURE

Not satisfied with a conventional rat trap, a Syracuse, N. Y., photographer has bunt lumself one that shoots the animal. takes a picture of the shooting, and records the time. By pulling a balted wire, the rat trips the trigger of a revolver that ends its

career. The shot severs a string attached to a spring-operated electrical contact, setting off a flash-light bulb. A camera left in the dark with shutter open takes the picture and a watch hung on the trap shows the time at which the shooting occurred.



The piecel shoots the rat and also sets off a dash-light bulb to take a picture of the event



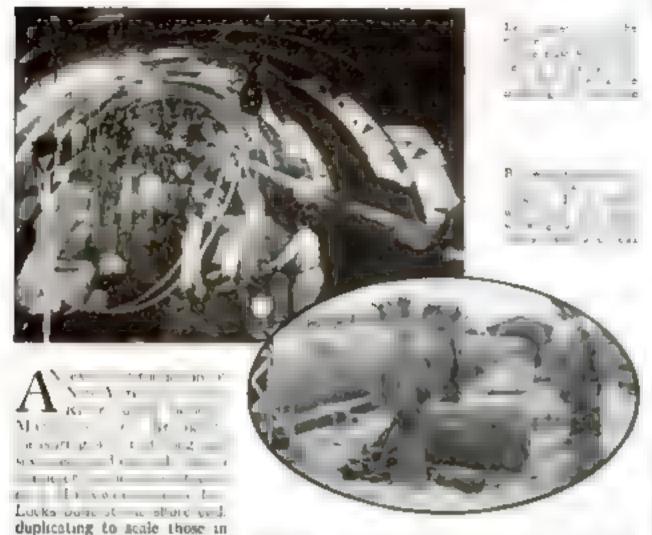
COMIC INSIGNIA MARKS MACON'S SCOUT PLANES

A PAINTED design showing a pair of acrobats swinging in mid-air decorates the fuselage of each of the tiny acout planes attached to the U. S. Navy airship Macon. The insignia cancatures the method by which the planes make contact with the mother ship in flight, through a book on the plane that engages a trapezelike bar suspended beneath the airship. A acrawny aerialist represents the scout machine, and a portly one the huge bulk of the mother ship, Macon.

INVENTS TONSIL BRUSH

Bauanting tonsils night and morning to clean and disinfect them, as a substitute for their surgical removal, as recommended by a London physician, Dr D Findlay, He has invented a special tensil brush to be used for this purpose.

RIVER TUBE REPRODUCED FOR MOVIES



are practical, so as to show actual work of construction during the picture. Much of the apparatus used was shipped west from tunnel jobs on which it was employed.



LAWN SWEEPER PICKS UP LEAVES AND RUBBISH

Sweeping up leaves, instead of raking them, is made possible by an odd hand machine introduced in England. Pushed across a tawn, it operates on the principle of a carpet aweeper, depositing leaves and litter in a capacious hopper at its rear. The new method, shown in the photograph above, is said to be both convenient and time-saying especially for parks and large estates where targe areas are cleaned.

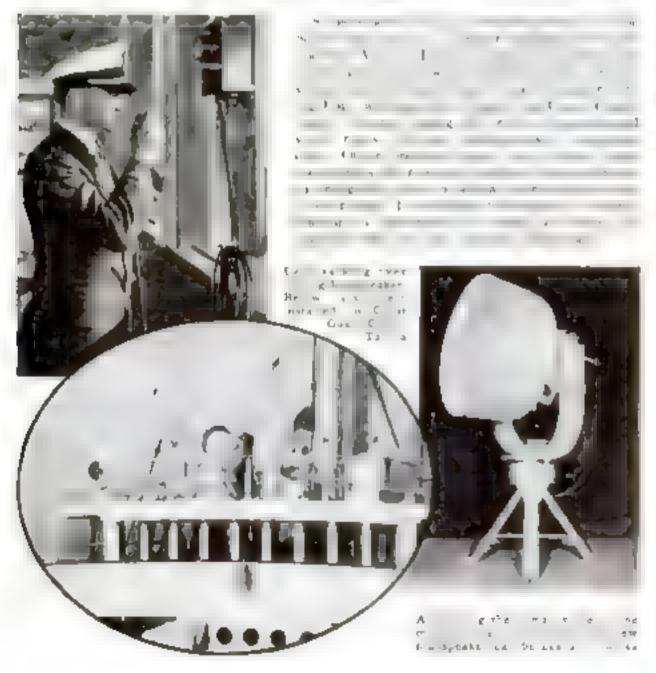
LOUDSPEAKER HAS VOICE OF THUNDER

operation on the original tunnel operate

during the filming of "East River." Shield.

working platforms, muck holes and erector

arms at the working end of the tunnel also-

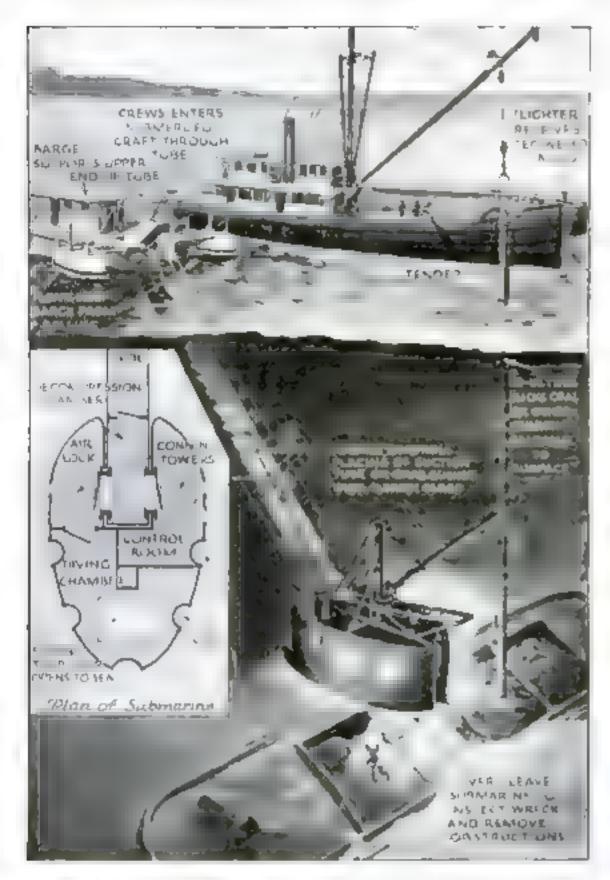




ROBOT PLAYS ANY TUNE ON SPOKEN COMMAND

A zernest-playing robot completed by a San Francisco dentist, after seven years of work, has a repertoire of 3,000 different airs. According to its maker, it executes any one of them upon a spoken command. The voice is picked up by resonators and sets in motion a complicated electrical mechanism, causing the hand of the automaton to pluck the desired strains upon the strings of the instrument. A part of the machinery is housed in the hollow interior of the figure, which is carved from wood, and the remainder in a chest upon which it reclines, as shown in the picture above,

Pumping Cargoes from Sunken Ships



Art at a drawing above how the estange scale designed by Esman Lake, propert submarine builder, will appear when as actual use to se vage builty congress from submarged vessels

Submarine Builder Designs Unique Vessel for Bulk Salvage Work

supplies air for the divers through a huge tube nearly 150 feet long. When the submarine chamber is submerged, the crew and divers enter it by descending the tube, which then inclines at an angle of about sixty-five degrees. An elevator, consisting of a wheeled car running on a track, is provided for the purpose.

Passing through a door at the end of the tube, members of the crew enter a control room containing a panel of knobs and levers that operate the crane. Divers pass through another door into an air lock on the starboard side. Here they remain until the air pressure is increased to equal the pressure in the diving compartment.

The diving chamber is reached through a watertight door. When the submarine is submerged, are pressure in this chamber is maintained equal to that of the water outside, to prevent the water from flooding the craft when a sliding trup door in the floor is withdrawn. Divers step through this door directly upon the sea floor. Using comparatively short air lines, they can move about freely

Under brilliant light furnished by five floodlights carried by the submarine, the divers clear obstructions so that the grabs or suction tube can reach the cargo. The vessel's crane, capable of swinging in a wide arc to either side of the craft, guides the buckets or tube to the desired spot.

Later on, the odd salvager is expected to be used for pearl and sponge fishing and for sinking wells into the rich gas and oil fields known to exist in many places beneath the ocean



Tube through which divote will reach the ocean floor

ESIGNED for undersea salvage, a strange craft just launched by Simon Lake, veteran American aubmarine builder, combines the principles of submarine boat, floating crane and diving bell. A twenty-two-faot-long submarine chamber, forming a part of the vessel, can descend to a maximum depth of about 100 feet. It will first pack out a submerged hulk with its powerful lights and then drop divers directly upon it. Finally, by means of its electric crane, it will guide grab buckets or a suction tube lowered by surface tugs to raise the salvaged cargo. Unlike most salvagers, the vessel will not concentrate upon gold and other precious metals, but with the aid of the suction tube will attempt to pump up coal and other bulky materials.

The surface portion of the vessel resembles a barge and carries a powerful compressor which



Submerine chamber of the salvage vessal, abowing the ports for the powerful foodlights

Wins World-Wide Fame

Perfected Technique in Use of Camera and Lens Enabled Amateur to Make Photomicrographs That Surpassed Those Made by Leading Professionals

By EDWIN TEALE

VE evening, seventeen years ago, a friend called at the home of Philip O. Gravelle in South Orange, N. J. He was starting on a vacation and wanted to leave a microscope for safekeeping, Graveile, who was nearly forty, had never looked through a microscope in his life. It was like putting on magic glasses. That instrument, left by chance at his door, started him on the hobby of a lifetime.

Today, at fifty-five, he has won worldwide honors in microscopy. He has been trace a Fedow of the R was Microscopical Society, a Fellow of the Royal 1to . graphic Society, and is the only man in America to win the covered Barnard Meral of the London Photomicrographic So ery He is the progrator of the comparison microscope method of tracing bulets to the guns that fired them. He has prayed a proncer role in at the brown croscope to incustry, on the to vertising. And he has accompashed a this in space hours and add many said work was over and he sought relaxation. He laboratory, built at the back of his home in South Orange, is probably the finest private workroom of its kind in existence. It is the dream of a hobbiest come true. Rows of instruments, cabinets of slides, shelves of auxiliary lenses, batterses of cameras, lights of a dozen kinds pack the room in orderly array. They represent almost every concervable aid to

In this paradise of the amateur microscopist, I recently spent the better part of a week-end watching Gravelle at work, A tall, spare man with grav-

The tip of a small's tongue, blood corpuscles battling an infection, colloid particles vibrating in a film barely one ten thousandth of an inch thick are among the wonders he photographs

Often be takes the same picture over and over, as many as twenty times, to get it exactly right. He works carefully, methodically, scientifically. He keeps a written record of everything he does. Each negative has a number and on the filing envelope in which it is kept, as well as in a master book, he piaces complete data on the camera, the microscope, the light, the film, the filter, and even on the paper and developer used to produce the finaprint. Any other microscopust, following this data, can produce the same results.

Behind his laboratory Grave le has a



IDEAL HOME FOR A HOBBY

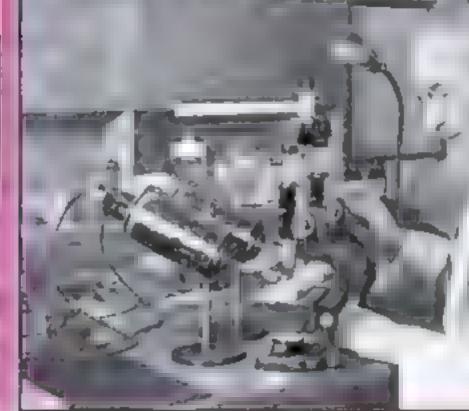
Above, onte ser of Grave'te a storeto y as sha reas of has home in he foreground in the nord where he gets many specimens. At right, Interior of the aboratory with Grave le and his or see any hard as work

Photom rograph above shows the germa that ER 154 A DEPOLIE BUR ness mage fed about 1 00 dente e a This in and of Graveles most queressio pouras

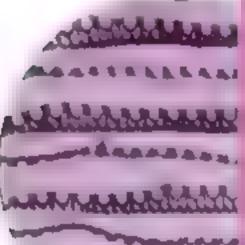
with Microscope Hobby



The figure of the photographer car on meno effected in this intergod picture of a cult age



and a graph of the property was on gar that



or was note in he Grave a a a p



state of aparts 4 4

With this special photomicrograph camera. which he designed. Gravel's is able to locks on an object while sooking through the side

pool dotted with by pods. It suspites an lmost encless stream of excit he advertures. From its water he fishes delicate organisms that expand under the microscope into fantastic creatures of plants of thousand weird designs, into living in game into blue-grav Acres 12 2 - Pastrange cagar shaped Principanae, plowing through microscopic debris like submarines

the range he found the water of the poer . I ment green. At first he though it was filled with pollen from overhang ing trees. But his miscroscope revealed it was teeming with a new kind of protoson

On the vellowing pages of a large record book. Gravelle has penciled notes that go back to the very first object be photographed. It was a drop of blood magnified 500 times. While his friend was away, he

n old view camera to the microscope and, using a gas amp with an inverted mantle for illumenat in took his parture. The exposure lasted three minstes. Today, with modern lighting, he obtains a similar photomicrograph in as

to he time his friend returned. Grn was poring over microscope calalogs. wing an instrument of his own. Daring the mone is that to lowed he added to his equipment, awapping apparatus, pick as a sale to his engrossing bonly 11 s tip to beginner is to avoid second-hand microscopes unless you have a friend who knows lenses and will help you

Ever since he was fifteen. Gravelle has been interested in photography. One of the most prized possessions of his laborafury is an original Daguerrentype care at complete with furning hox and chemical bottles, which dates back to within fifteen years of the beginnings of photography Unother relic of the early days is a Whalmsley "Handy" It was made in 1894 and was one of the first cameras used in taking photomicrographs

During his education at Columbia Linversity and Pratt Institute, Brooklyn N Y his interest in camera work led him to p. to in chemistry. Atter he had becone a designer of textale patterns, with offices in New York, he continued his hobby, concentrating on landscape and color pictures. This photographic background has been of immeasurable aid in making snapshots of the invisible.

The early pages of Gravelle's record



Gravette exhibits here a genuine Daguerreotype camera with fuming but and chemicals

book are filled with a curious list of things he photographed, the ladneys of a cat, the blood of a frog, the frends of invisible plants floating in a drop of water, deas, molds poilen. Everything was new and faccinating. He was a scientific Gulliver

exploring a land of Lalaput,

A few months after he had taken up his hobby in earnest, a paint manufacturer to Newark heard of his photomicrographs and brought him his first paying job It was taking magnified pictures of pigment particles. As the covering power of paint depends upon the size of the pigment particles the manufacturer wanted to know how long he would have to grind pigment to reduce the particles to a certain size Gravelie's photomicrographs told him and the check he sent in payment immediately went into the purchase of new equipment. Lake a farmer plowing in fertilizer, Gravelle has continually plowed in the profits from his pictures to obtain new and betler apparatus.

Many of the pictures of magnified objects you have seen in the advertising sections of leading magazines have come from Graveile's home laboratory. One, illustrating the way shaving cream fills the spaces between the hairs of a beard, was run tenyears ago and found to be such an effective display it was revived again this year. Gravelle was one of the first to take highly enlarged pictures of the cutting edge of a razor blade, showing how the beard nicks

and chaps the steel

As a pioneer free-lance microscopes in industry, he has produced magnified pictures of silk, tobacco, soap, yeast, coal, milk, metals, pencils, pens, rasor blades, mayonnaise, cod liver oil, ink, and a host of other commodities. He has belied turn out better newspapers by showing how the crystals cool in stereotyping plates and how the link soaks into various kinds of paper. He has aided in textile manufacturing by revealing what happens to fibers in various weaves of cloth. In all, he has laken pictures or belied solve problems for more than 100 American concerns.

Once a silk manufacturer asked him to

photograph the initial steps of a run in a stocking. The tiny, subvisible breakages revealed by his photographs beined the company turn out better stockings. In another instance, one of his pictures which magnified 2 000 times runous, pollywogake partities in a rubber composition played a big part in winning a million-dollar law-suit. On several occasions, discoveries made in his laboratory have resulted in the introduction of new products or the altering of old manufacturing methods.

A few years ago, for example, a producer of plaster of Paris came to Gravelle with a mystery he couldn't solve. For nearly a dec-



As the first step in preparing specimens, Gravelle fracton them in this expensive. Then they can be set in olices makelievably this

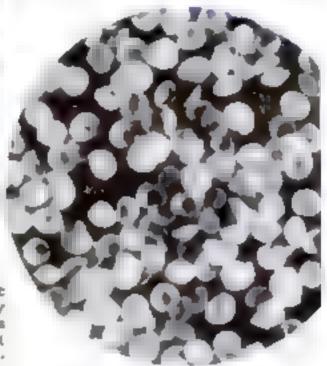
ade, his product had been a leader in the market. Then the public had suddenly veered to a rival's brand. Experiments showed that it set more rapidly. Yet chemical tests revealed both plasters contained exactly the same ingredients. Gravelle adjusted his microscope, focused his camera, mapped his shutter and solved the mystery. The rival manufacturer was simply grinding his plaster into finer purticles. By an easy alteration in factory methods, his client was able to restore his product to its former favor

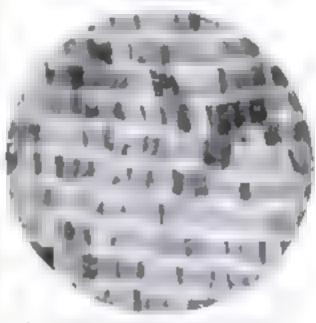
Among the thousands of photomicrographs you see on file in Gravelle's laboratory is one remarkable picture revealing how plaster of Paris sets. It shows clearly the mass of interlocking crystals that hold the plaster together. Another unusual print demonstrates the way a drop of water may act as a magnifying lens in ministure. It is a photomicrograph of rancoat material, the fibers under several waterdrops appearing with added magnification.

At the time he was thus helping provide industry with a new eye, Gravelle was also engaged in an even more exciting adventure. In 1925, he joined with Charles E. Waite, John H. Fisher, and Col. Calvin, Goddard, in establishing the Bureau of Forensic Ballistics, pioneer organisation for tracing bullets to the guns that fired them by comparing the scratches on the lead left by the barrels. The technique he worked out, as the microscope expert of the bureau, is now used by scientific trimmologists throughout the world. As an eloquent silent witness, his photomicrographs have figured in a number of celebrated murder cases, not only convicting the guilty but saving the innocent as well.

Because a single variable element would upset the scientific accuracy of his photomicrographs and make it impossible for him to achieve the same results every time, Gravelle cooperated, several years ago, with engineers of the General Electric Laboratory in producing a new kind of lamp. The old are light be used sometimes varied in intensity so be suggested a ribbon filament tungsten lamp that would overcome the difficulty and always provide the same intensity of light.

On several occasions, his home workshop has been turned into a movie set where actors too small to be seen by human eyes performed their parts. One reel, which has since been released as a teaching film, recorded the life cycle of the rotifer, that strange subvisible dweller in stagnant pends. Another made for a manufacturer of surgical natures, depicted the thrilling drama (Continued on page 116)





Top circle, young owners as they appear in a photomicrograph when enlarged thirty dismeters. Above, magnified wing of a betterfly showing shinglelike attracture of covering

Dog Learns To Spell and Cipher



Joe can pick out the flags of a held dozen nations, in any order they may be named. This is the se especially interesting in view of the opinion prevailing among experts that dogs are color-bland

N STATEN ISLAND N Y., a black-and-tan Ger man shepherd dog is now learning to write his name with a piece of chalk. Experts say that writing is beyond the power of canine intelligence. However, this particular dog, Joe by name, has already upset some of their pet theories by learning to read, spell, dis-Linguish colors, and solve problems in arithmetic

Joe's owner, Frederick S. Forde, has trained him solely as a hobby. At first he had no idea of teaching the dog anything beyond the rudiments of good canine conduct, but Joe learned so readily that Forde kept on. Today, at five years of age, Joe has mastered enough mystifying stunts to hold an audience spellbound for an hour

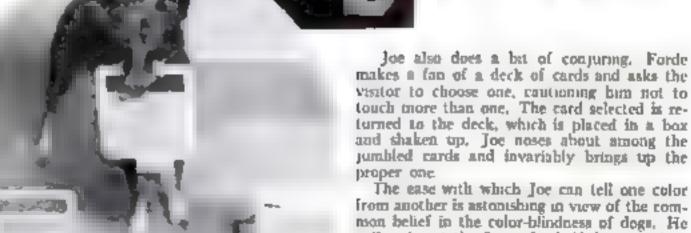
The dog's specialty is arithmetic. At a word from Forde, Joe places his fore-free on the edge of his counting box. So that he cannot catch visible signals, a pair of goggles with painted lenses is put over the dog's eyes, and to make sure that he will not get a cue from his master's voice the skeptical visitor is asked to put the questions

One after another the questions are fired. Joe is asked to multiply three by mx and then to subtract eight. Promptly, Jueplaces a forepaw on the bell clapper in the box and rings the bell ten times

Written problems are presented by placing pointed numbers and arithmetical symbols on an easel. Joe is required to multaply rung by six and to subtract eight. With only a casual grance at the board. he taps out the answer with unfailing accuracy.

From a full alphabet in wooden brock letters strewn on the floor Joe will pick out his name, one letter at a time, either forward or backward. He can also rec ognize his name when it is written on a slate.



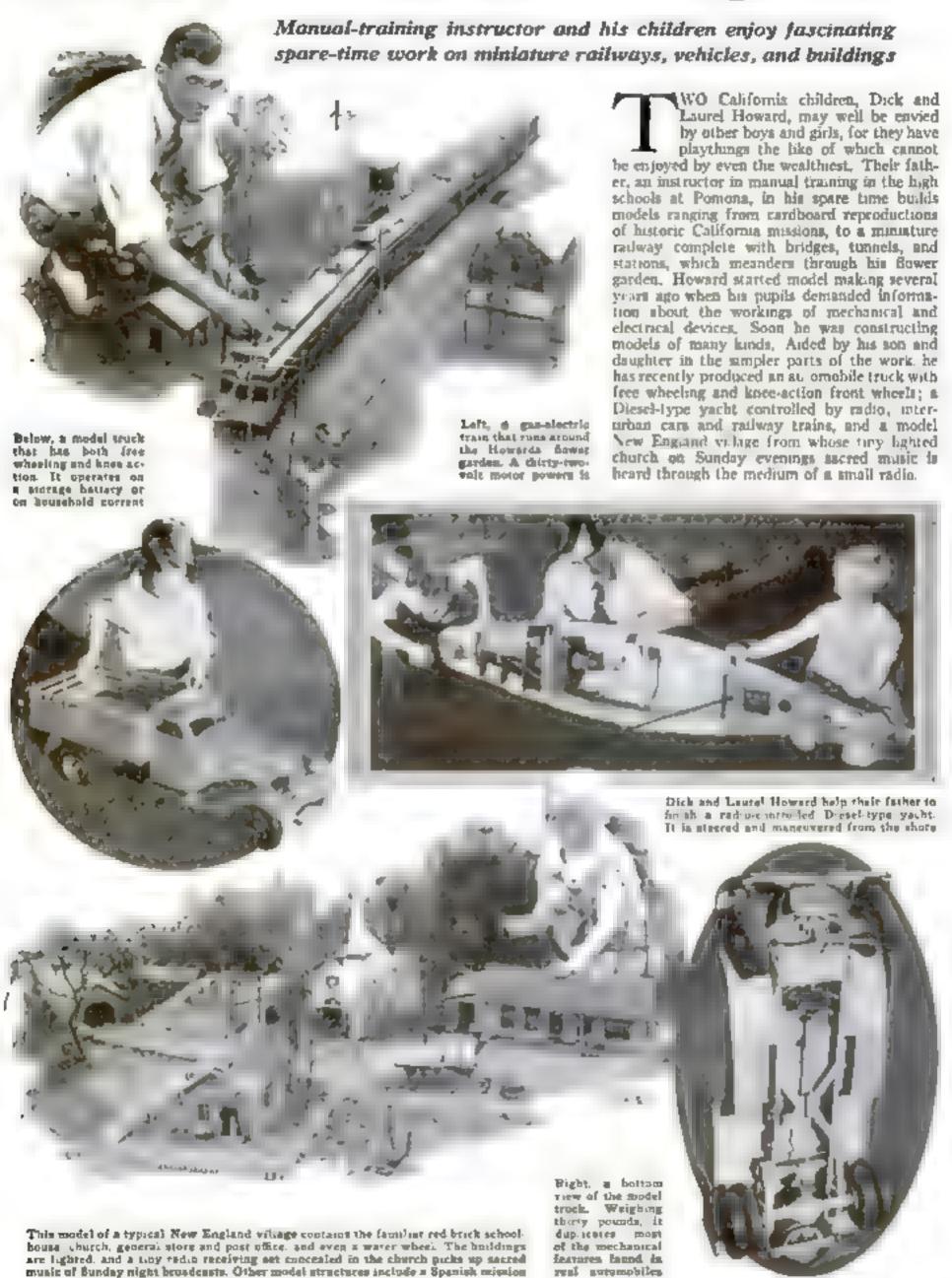


From a group of clates on which different words have bean written, Joe chooses the one bearing his name

makes a fan of a deck of cards and asks the visitor to choose one, cautioning him not to touch more than one. The card selected is returned to the deck, which is placed in a box and shaken up. Joe noses about among the jumbled cards and invariably brings up the

The ease with which Joe can tell one color from another is astonishing in view of the common belief in the color-blindness of dogs. He will park out the flags of a half dozen nations in any order his owner names, and does another stunt in which he uses disks that are unmarked except for their co.or. He has been taught only a few police tricks but he can scale a thirteen-foot wall, disarm a man and guard his prisoner by knocking him down and refusing to let but rise.

Family Joins in Model-Making Hobby







If the old manual who is we we come the source of your C. w. New haus so hed dements we he will have been mined as a context of the context o



FORTUNES in Back Yards

TWO Bastamere lads, digging a hole in a control long age than the a part home g \$11,000 in old gold toms. What is not have tome to make a mark to the result in the first and to the result in the first and to the result in the first and the result in the

egawa fewsteraha at 1 serve gaka kerefnatura gar ist al The inggash with tione part of epis kegage Bere e to ka habine The die Jones tele and Henry Grib of Henry Grib of Henry Mill will part the Book on the dig good a book of the latest one It as not known as his will have a both they may also be a find.



Russell Crocket a high-school boy of Moodeahs. Kens, or lied a hole in his back yard with a post-hole suger and struck oil. The success of his first well inspired the amazeur oil man to draft two more of them

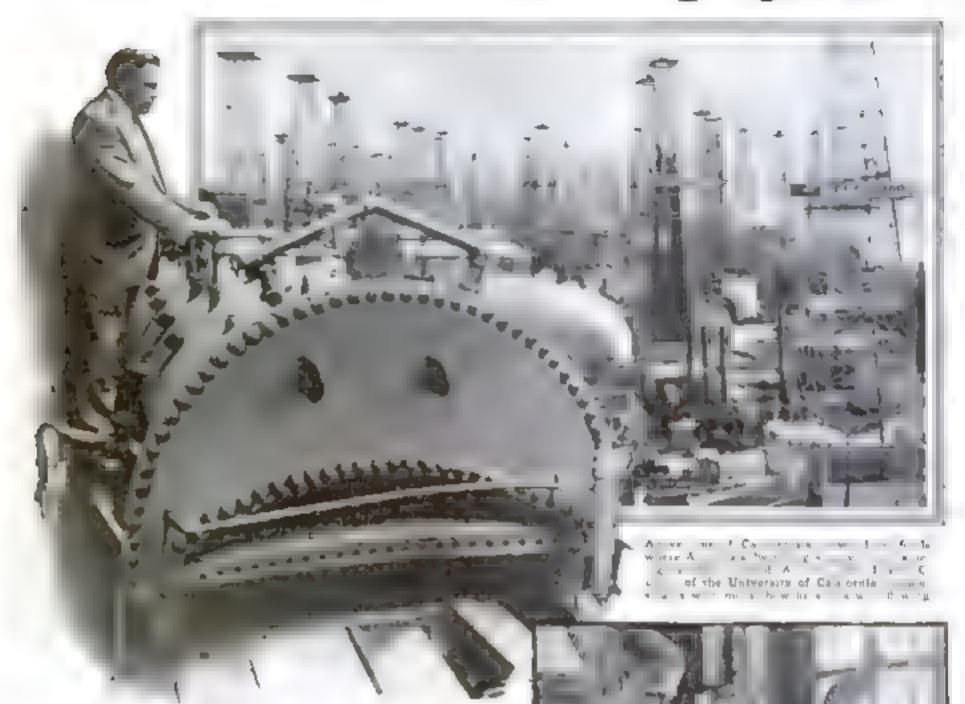


Left an oil well in the back yard. Unexpected was the came to the owner of this property in Kansas City, Kansas when the laying of a gas main revealed the presence of oil. The drilling of a well brought in a flow of this ry bar rela of oil a day.

Walter Riebling, of Overbrook Paneed never worry about fuel bills. When his coal bin is empty, be has only to take a pick and above into his private coal mine tendermenth the bouse and dig a supply. As above in the phone at the right



Earth's Last Drop of Oil

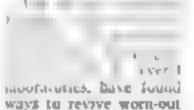


now hidden in the depths of the earth have been anded to the nation's wealth by new discoveries made in a haby oil field and miniature oil wells, where a novel tube, representing a section of sand at the bottom of a typical well has been successfully used.

Pro c or Lester C Uren of the Levers v. r. Unforma petroleum engancing i o y, working with other scientists has solved problems which long costarbed on men who saw the United States' oil reserve rapidly dwindling. He and his associates have found in their laboratories means of giving new life to depleted fields, and thereby have added fully a half-century's supply to the fifteen-year supply available by present methods.

To date sixteen billion barrels have been drawn from American wells. In untapped fields ten billion barrels are known to be ready for the drill. Since Prof. Uren's researches with the small models of producing units and other data from the field and laboratory demonstrate that underground pressure and pumping bring to the sariace only one twentieth to one fourth the total supply, there remain some 114 billion barrels of liquid gold in American fields, including 104 billions now added to Uncle Sam's known oil endowment.

B)
ROBERT E.
MARTIN



napotacotics. Bave found ways to revive worn-out fields and conserve new ones which promise to result in a yield of from

two to three times the quantities originally withdrawn, and in some instances the recovery may equal four fifths of all the oil known to exist around a well.

Of all the oil that has been wrested from the earth, nearly two thirds has come from the United States. In recent years this country has supplied almost three fourths of the world's petroleum needs. With only a fifteen-year visible supply promised by present methods in present known fields, engineers have been battling for new information on fundamental problems which could be turned to practical account in the pil fields.

By forcing oil into a core enclosed within a steel barral. Prof. A. J. Carleon, of the University of Carleonia shows how he see able to determine the permankative of sand that contains on

In the University of Cauforma petroieum laboratory, I saw enacted on a small scale the experiments which led the engineers first to understand conditions beneath the earth's crust, then enabled them to prescribe ways and means of forcing new crops of oil from reservoirs no buman eye has ever seen.

Ten times Professor Uren pumped natural gas under high pressure into the miniature oil field and ten times oil flowed through pipes representing full-sized wells. Each time less oil emerged from the tightly packed sand, yet following the tenth flow nearly half the amount placed orig-

Sought by New Discoveries

inally in the steel tank had been forced out exactly as pressure forces oil from reservoirs under the earth's surface

Near-by a mixture of oil and natural gas, under pressure as high as 2,600 pounds to the square inch, was forced into a twenty-foot steel tube falled with sand. Within this tube had been created on an actual field scale the conditions surrounding the bottom of a well in a high-pressure field. At intervals gages recorded the diminishing pressure, thus revealing how oil loses its pressure on approaching a well.

It is with these devices that Peof Uren and his colleagues reproduce oil-field con-

ditions in miniature. Researches conducted in the University of California laboratories, California Institute of Technology, University of Oklahoma, Colorado School of Mines, and by the United States Bureau of Mines, not only reveal that large reserves of oil not recoverable by ordinary methods exist in present oil fields, but that from two to four times the quantities removed by present methods may be forced from the earth by these new means.

The miniature oil field demonstrated that repressuring, or forcing of gas, air, or water into an oil reservoir, will yield more oil than flows by batteral pressure and

pumping. This device, which has vielded such sensational results, it the counterpart of an anticlinal structure. It consists of a steel tank shaped on the end like a resecent moon, with the points down, and measures five feet wide and eight feet long, while from its rounded top project a series of pipes. These are the oil wells, which may be caused to flow singly or in any combination.

Inside the tank, sand is tightly packed to duplicate the structure of a common type of oil stratum. When ready to operate his oil field, Uren dissolves natural gas in crude oil, exactly as it occurs underground, then forces the mixture into the tank under pressure. When the oil and gas mixture has filled all the spaces between the sand grains, the tank is in the same condition as an underground pool. The depth depends upon the pressure applied

To duplicate the opening of an oil well, a valve on one of the projecting pipes is turned and at that moment, oil, forced outward

by expansion of the gut with which it is mixed, begins to flow through the pipe much as it would escape from a new gusher.

Here, in a few cubic feet, important problems of draining large oil fields, of drawing from the earth the last possible barrel of oil. Are being solved

barrel of oil, are being solved.

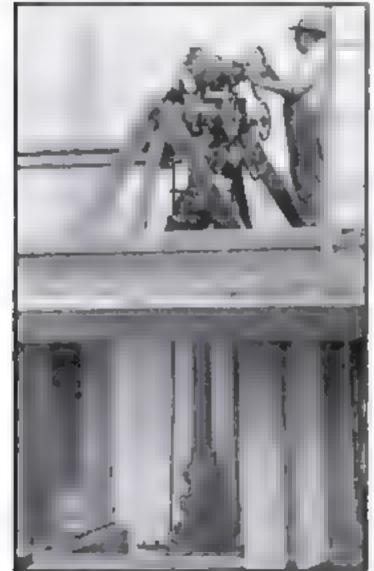
"Drainage," Uren explained, "offers more problems than any other phase of oil production. We learn from the miniature field that flush production, represented by wells flowing without pumping and pumping, yield only about one fifth of the oil actualty in the buried reservoirs.

"Means to recover the remainder are vitally necessary. First, however it is important to know how oil behaves under varying pressures and in different kinds of sand. While gas pressure, pressure of water surrounding the reservoir, and gravity tend to force oil toward a well, capillary attraction of the pores of the reservoir rock, adhesion of oil to surface of the sand or rock, and the friction occurring as oil outes through the initiate pores tend to boil it back

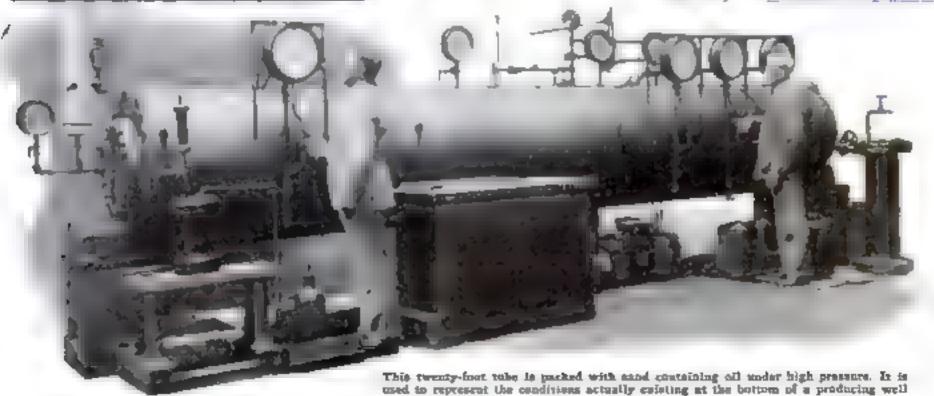
Gas pressure may be tremendous. It is estimated that in the Kettleman Hills Oil Field, in California, where initial field pressures of upwards of 2,500 pounds per square inch exist as much as 000 cubic feet of gas can be dissolved in one barrel of oil. This means that when a well taps such a reservoir, thereby releasing the pressure, the oil expands to about 120 times its original volume until it becomes only a thin film of grease surrounding countless gas bubbles. This expigins why, when a well is brought in out of control, the wild oil stream blows the drill rig to pieces and showers the ground with oil for miles around.

"You would think such a force would draw oil from the earth with case. But that's only part of the picture. You must remember that a cubic foot of sand may contain as much as 25,000 square feet of surface which must be wet with oil. To get this adhence oil away from the sand as no easy matter."

How may (Continued on page 132)



Left, using a device known as a 'Christman tree " to shut of a well and thus control its volume of flow



HEAT CLIFF TO CHECK LANDSLIDES



TINY RADIO AND SPEAKER FOR COPS ON BEAT

A New self-contained radio receiving set, designed to be carried by a policeman while walking his best, employs a loud-speaker instead of the carphones usual with such portable outfits. The speaker is carried in the breast pocket of the shirt or tunic and is connected by wives with the receiving apporatus suspended from the belt, which also supports the batteries.

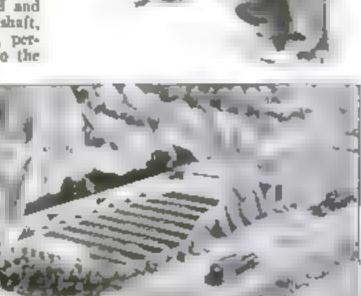
SELL AIR MILEAGE BOOKS

"Meal-ticket rates" for ordine riders have been announced by two American transport companies. By buying a mileage book containing \$500 worth of transportation, passengers can save fifteen per cent on regular rates, officials say.



Installing a heating plant in the base of a 200-foot cliff, to stop landshdes endangering homes and grounds at its top, was an unusual expedient recently tried with success in California. The slides were caused by water acoping out at the base of the cliff. To dry it out, a tunnel was dug parallel to the face of the cliff and 120 feet back from it. From this shaft, at intervals of about twenty feet, perforated ten-inch pipes were laid to the

face. The ends, terminating in open air, were left open but were covered with protecting caps. An electrical warm-oir furnace was set up at one end of the cliff, with motor-derven fans to drive the air along the tunnel and out through the perforated tubes, Auxmary tunnels, dug to facilitate building the main shaft, facilitate dramage, and remaining moisture is effectively disposed of by the heating plant, which will be operated whenever the amount of moisture requires it.



Drawing shows how hot six to distributed to dry the giff's face

NOVEL PIANO HAS SIX-ROW KEYBOARD

UNUSUAL munical effects are produced by a chromatic piano now being demonstrated in Germany. The half-tone keys instead of being black and raised above the level of the others, are white and are placed side by side with the full-tone keys. The keys are disposed in six short ranks in place of the usual one long row, so that the player can span two octaves at once and may produce the same tone simultaneously on three different rows. The chromatic piano invented fifty years ago is only now being built commercially. The piano aroused interest by novel effects produced.



A musician demonstrating the chromatic pione. Half-time keys are aide by side with full-tone keys, in six comparatively about rows





Heating plant set up to dry out a cliff Below the open end of one of the perfotated bot-sir pipes

BABY SWITCH FOR HIGH-POWER WORK

A NEWLY developed switch, no larger than a spool of thread, is capable of interrupting a current equal to five botsepower, a job that commonly requires a switch many

times its size. Because of the vacuum in which the contacts operate, it eliminates the arcing flash which, with its attendant high temperatures, makes necessary the heavy construction of the ordinary high-power switch. Lead-in wires are insulated by glass beads encased in special metal alloys. The illustrations show the exterior of the switch and its internal construction,



AN AIRPLANE COOstructed by a Coatesvalle, Pa., inventor is able to dy with or without a tail Recalling the appearance of craft built in the pioneer days of aviation, the high-winged biplane is powered by a four-cylinder gasoline motor operating a single tractor propeller. The pilot sits amid open framework, as seen in the photo at left, in which the son of the inventor is shown piloting the machine with its tail removed for a test.

At top, test picture of finish of home race made with the high-speed timing camera shows above

HIGH-SPEED CAMERA TO DECIDE HORSE RACES

PHOTOGRAPHIC evidence, maker than the optnion of Judges, will nick the winners of horse races in a system to be tried out for the first time this month at the Santa Anita track near Los Angeles, Calif. The system uses a high-speed timing comeradeveloped by Western Electric engineers, and permits results to be announced, and photographs of the finish to be posted for public inspection, within three minutes after each race. Cameras at the finish are started just before the leading horse crosses the line, and the section of film recording the end of the race is then rushed through a high-speed developing cabinet of new design where developing and fixing are completed in thirty seconds each. An operator views the developed film as it passes between two glass plates in a wet enlarger. As the frame recording the firmsh of each borse comes into view, he presses a button, automatically stopping the film and making a bromide enlargement to be rushed to the judges. Under present procedure, winners of the race are posted immediately, but bets are paid off only after the horses have returned and the jockeys weighed in. With the new system, prints will be in the judges' hands, for their final decisions, by the time the jockeys have weighed in, and duplicate prints will be on view at the betterg booths immediately afterward. The prints show not only the order of finish but also the time of each horse. The system also comprises auxiliary timing apparatus and ordinary motion picture cameras spaced at intervals along the track, to time the entire progress of the race and supervise the conduct of the jockeys at all points on the race course.

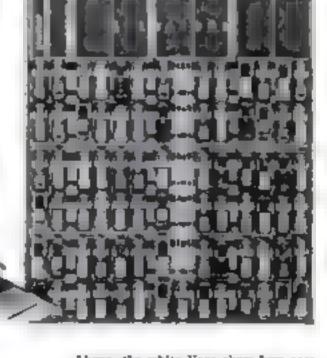
RADIO PICTURES REPRODUCED ON PAPER



Messages, maps, and pictures transmitted by radio are reproduced on poper, at the rate of a full letter-sized sheet every cuth: minutes, by an improved facsimile receiver perfected by RCA-Victor Company engineers Synchronized with the transmitter, which operates on a standard scanning principle similar to that of television, it feeds carbon paper and white paper from rolls over a rotating drum bearing a sparal ridge. Fluctuations in incoming signals press the paper and carbon together against this ridge, making marks corresponding to the light and shade of the original. Early commercial use of the system is foreseen,

CAR-PARKING SYSTEM WASTES NO SPACE

WITH a new car-pariting device approximately ninety-five per cent of the area of p garage floor or parking lot can be used for storing care. In ordinary parlong, about a third of the area must be kept clear to maneuver cars in and out of position. The new system employs two continuous motor-driven tracks for each rank of automobiles, one track for the tear and another for the front wheels of the cars. A file at one side of the floor is left vacant. When a car in one of the rear ranks is wanted, pressure on a button moves ande the cars on the front ranks, thus clearing a lane for the rear car to be driven through to the exit,



Above, the white lines show how cars are moved aside to permit the rear car to leave the parking space. As left, closeup view of the two lateral tracks on which the packed campre awang sidewise

New Machine Harvests Cotton by Suction

Designer to speed up cutton harvesting, a machine invented by a Gamesville, Texas, insurance man operates by suction. This is provided by a huge blower mounted on a tractor and actuated by its engine, in such a way that the blower has two speeds independent of the tractor's movement. Five men besides the driver ride the machine on sents suspended above the cotton rows, picking the cotton and dropping it into funnels attached to metal boses that carry It to the blower. The funnels may also be detached and the hose guided by hund, the suction plucking the cotton from the bolls. In the blower, the cotton is removed from the burrs and burled into a screen container Tests in Texas fields showed that twice as much cotton was gathered in one day by the barvester's crew as by an equal number of men picking by hand. The process is reported not to interfere with unmatured bolls.



ANGLER DESIGNS REELS OF ALL SIZES



Bumbive a fishing reel so tiny that a fivecent piece would cover its side plates, or so large that it holds four noles of linen line, are equally easy tasks for J. A. Cose, expert deep-sea angler and former president of the Catalina Tune Club in California. These are the smallest and biggest of the many reels he has designed and constructed for fellow anglers. The occupation was virtually thrust upon him when friends, admiring an "unbreakable" model he made for himself, demanded similar equipment,

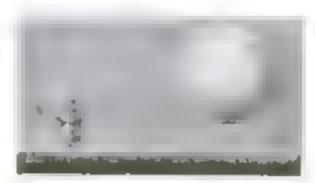
ELECTRIC MACHINE SPINS SPIDER WEBS

Wife's one large mot on-picture studio needs cobwebs for a scene, it manufactures them with a home-made machine

that spins webs as time and natural looking as the reathing. The device consists of an electric band drill, the blades of an electric fan, and a conical metal container. This metal cone which has a perforated base, holds a quantity of liquid rubber and, like the fan blades is attached rigidly to the shaft of the drill. When the fan blades are revolved at high speed, they cause a strong current of air which in turn creates a vacuum at the base of the cone, drawing fine filaments of the liquid rubber through the perforations. By careful movements of the machine, cobwebs can be produced in almost any pottern that may be required.

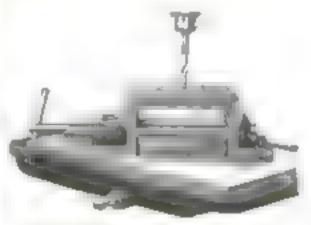


This electric fan draws out liquid rubber to form cobwebs.



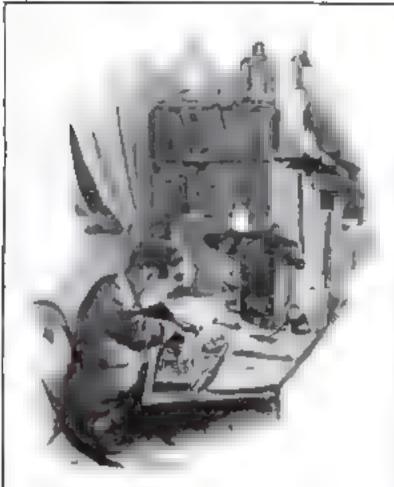
NEW GOLF-BALL TEE REVOLVES WHEN HIT

Soarthing new for golfers is a spinning tee devised by a Chango inventor. Whirling freely when atruck it is claimed to offer no resistance to impede or deflect the drive. Since there is little chance for the club to strike the tee fiscif, it is seldom lost.



NEW DRILL-PRESS VISE QUICKLY TRUES UP JOB

Work, resting on built-in parallels in an improved drill-press vise just introduced, is speedly and accurately trued up for drilling. The new design dispenses with the use of separate parallels, and the clearance it provides minimizes interference from chips and burrs. The vise may be used standing on its base or on either side and has a V-notch for holding round shafts.



You Never Can Tell

By BERTON BRALEY

If your scion loves to putter
With the innerds of a lock

And he builds things out of gadgets that you own,
If his room is all a clutter
With the pieces of a clock

And he will not leave your set of tools alone
Watch your temper! Do not uiter
Words you'd better hold in check.

Give the kid's imagination coom to room;
Make him tidy up the clutter
But don't jump upon his neck

For you may have an Inventor in your home!

Of a "regimented" ind

Who was never any bother to his dad;
Ford had funcies in his needle

And a lot of things he did

May have made his troubled parents pretty mad.

When you find some new appliance

Which your son has ripped apart.

Don't assume there's only matchief in his dome,

For it may be love of Science

That is budding in his heart

And you may have an Inventor in your home!

If your eager boyish tinker

Sort of meases things a lot

Make him put them back in order when he's

through,

Putnesses's downt a future thinker

But--don't daunt a future thinker, Like a Term or a Wett.

Who may show the way to wonders that are new?

PUTS RADIO IN BABY CARRIAGE

A CHICAGO father has made has strolls with the baby carriage more enjoyable by building a radio into the vehicle. He mounted the receiver itself upon the foot rest, and for power tucked batteriesof aircell type into the botlom compartment The loudspeaker is directed straight downward, and provides a serenade at will to entertuin baby or parent,



A new are lamp, burn ng twin paica of carbons, furnishes strongest light

RECORD LIGHT FROM NEWEST ARC LAMP

A DARKLING new carbon are light recently developed in connection with chemical research. is raid to shed a brilliance twice as great on any princial light hitherto produced. In principle it differs little from the sputtering old street lamps in use thirty years ago, but in size and bunding radiance the new lamp represents a tremendous advance over the somewhat simthe primitive lights. In experiments conducted with the amp. scientists have shown that carhen, unlike the majority of common substances, does not melt or boil before passing into a gaseous state. They have discovered that it is transformed directly from a solid into a gas at a temperature of nearly 6 400 degrees Fahrenheit as produced by the arc

NEON LIGHTS TRANSFORM TRUCK

BEDELKID W h 600 feet of neon tubing, a gasoline truck placed in service by a western oil company glows like a Christmas tree as it travels along the road. Those who see the startling appear tion of zed, blue and yellow light find the explanation in clominated lettering advertising the firm's product. A decorative effect is secured by outlining the whole truck body including radicator fendera, tops, sides and rear, in colored tubing. Four highfrequency general loss, operated from the fan drive of the motor, supply electricity for the lighting system, which is said to be unique



This gasoline truck is outlined with meen lights of various colors that glow to 600 feet of tub og. The radiator has golden light and the landers have blue

Flying Battleships

By ALDEN P. ARMAGNAC

ATTLESHIPS of the air, spouting death from bristling cannon, will sail majestically across the akies, exchanging acreaming shells and blasting one another to atoms

high above the earth.

No fantastic nightmare is this arresting picture. It represents the suber opinion of many an informed mintary observer as to the role of the airplane in the next war. That planes will be bard each other at long range with high-explosive shells, as warships of the sea now do, is a startling, but logical, consequence of the development of aviation's latest and most terrible weapon, the flying cannon.

Only the other day a big French war plane successfully fired a three-inch gun 3,000 feet abthe earth. It gave an idea of the type of artillement, all unknown to the average civilian, is better developed in guarded workshops for future that has been battles. Several powers are known to have read at this moment, should war occur, aerial cannot that make the machine guns of the last war seen

puny by comparison.

Besides the three-inch gun just mentions. France has a twenty-mi-limeter cannon for play that can hard 400 shells a minute into the thus firing explosive projectiles almost at minchine-gun speed. British designers have countered with a thirty-seven-millimeter cannon that fires 100 rounds a minute. Information as whether any type of airplane cannon is under development by our own air farces is considered by U.S. minutary officials but few powers besieved to be neglecting its consideration for its terrific striking power seems destined to effect a virtual revolution in air factors.

Two factors give the new weapon its tackpower. First, a flying cannon far outranges a
machine gun, so that a pilot armed only with a
machine gun could be bombarded long before h
could fire a single effective shot in return. Secand, a plane may be riddled with machine at
bullets and suffer no serious damage, if no a
part is struck; but one direct hit with a hig
explosive shell anywhere on the machine is a
most certain to put it out of business.

Spurred by these incentives, the race among powers to develop a nuccessful airplane cannon began as early as the world war. During its year, France bombarded enemy ground positions effectively with thirty-seven-millimeter cannon mounted in Voisin two-scater planes. Guynemer and Nungesser, famous French aces, later tried out air cannon of equal caliber in actual air battles. Since these were single-shooters, mounted

in single-seater planes, the pilot had not only to guide his machine but to load, aim, fire, and reload his gun for every shot. Therefore Guynemer also carried a pair of machine guos, and when asked whether these or the cannon had downed a foe, he replied that he did not know, for he had simply given his adversary "the works."

Toward the close of the war, the United States was experi-



HOW ARRIAL MAVIES WILL PIGHT THE NEXT WAR

Air battles of the future will be fought in this manner, according to our artist, who visual see the effect of high explosive shells. The cannon here illustrated has already been matalled in British airplanes and may be adopted by other nations.

menting with one of the strangest of aircraft cannon, a gun that fixed two ways at once. Intended for use against submarines, it builed a powerful shell forward, while a harmless charge of bird shot and vascime was expelled from the open rear end to take up the force of recoil. The gun was fitted with stops so that the rear charge could not hit the plane, which did not interfere with pointing the weapon downward at the water.

Mounted in a huge samplane, this English deversped flying cantum from a thirty seven-milemeter captus vs shell that is capable of purting a plane out of commission with see shot

A machine gun was attached to its barrel and was intended to be fired first, the big gun being discharged when the bullets splashed near the target. None of these guns had passed the experimental stage, howover, at the time of the armistice.

MACHINE-GUN

AMMUNITION

After the war came the transformation that made the aeria, cannon no longer an experimental weapon but one of deadly effectiveness—the change from single-round to automatic firing. From later refinements have developed two distinct types of air cannon best illustrated by models currently installed in war planes.

French designers favor a fixed rangen that the pilot aims by pointing the entire plane at its target. Their pride is a twenty-millimeter rapid-fire cannon permanently fixed between the banks of cylinders of a V-type airpiane motor and designed integrally with it. Its amazing 400-round-a-minute rate of firing is attained by loading its projectives through a comprehend-air system, operated by an auxiliary comprehen attached to the motor. Through a unique expedient, there is no need to synchronise the gun with the

propeller buildes past which it fires, since the projectiles are shot through the hollow hab of the geated propeller. Suc gun can be handled effectively by a lone pilot, and has been

Installed in French sing e-seater fighting planes.

British design prefers a movable cannon, handled by a gun ner who is not required to concern himself with piloting. I latest achievement is a thirty-seven-millimeter gun that can be swing in any direction, using its own recoil to load and fireliher of two types of projectiles at the rate of 100 a minute. One is an explosive shell for use against hostile aircraft, which has a sensitive contact fuse that explodes it on striking aircraft fabric. Should it miss, a "tracer" fuse destroys the shell before it fails to earth lest it descend in friendly territory. The other type is a delay-action, armor-piercing shell for use against tanks and submarines. Several large flying boats of 100-foot wingspread have been equipped with this gun, which has sufficient recoil to check by ten miles an hour the speed of this mighty craft.

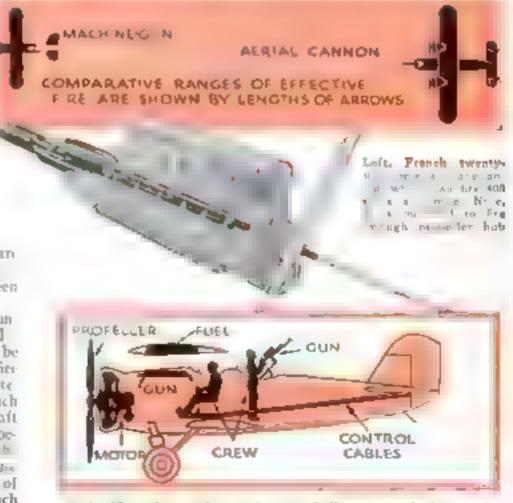
How Nations of the World Are Engaged in a Feverish Effort to Develop Destructive Air Artillery Is Described in This Article

The recoil of such powerful guns might seem likely to tear so fragile a structure as an airplane to pieces. What most persons do not realize, however, is that an airplane in flight is, by its very nature an ideal recoil-absorbing platform. The fact that it is surrounded by nothing more resistant than air, and the elasticity of its own structure, minimize the shock of discharging a big gun; and the larger the plane, the larger the gun that can be carried and fired. It is said that the two giant DO \(\lambda\) planes, largest of their type in the world, recently purchased by Italy, are provided with gun empiacements. What type of cannon might be carried in traft of such size and what havor they might work in warfare can only be left to the imagination.

Thus the amplane becomes a more potent factor in battle strategy than ever before. As well as shelling each other with such weapont, aircraft will be able to constitute themselves as ultra-mobile artillery to attack columns of troops radway trains, sire egic enemy lines of communication, and hostile sear, hight hatteries. While ground artillery is not susceptible to rapid transport from place to place to meet the shiring tides of lattle, airplanes equipped with flying cannon could be dispatched at a moment's notice during the height of a conflict, and could speed at a hundred miles an hour to critical points, arriving in time to play a decisive part in the struggle. Had squadrons of such craft been available to either alde during the world war, it seems reasonable to suppose that the history of many of its major butties would need to be compariely rewritten.

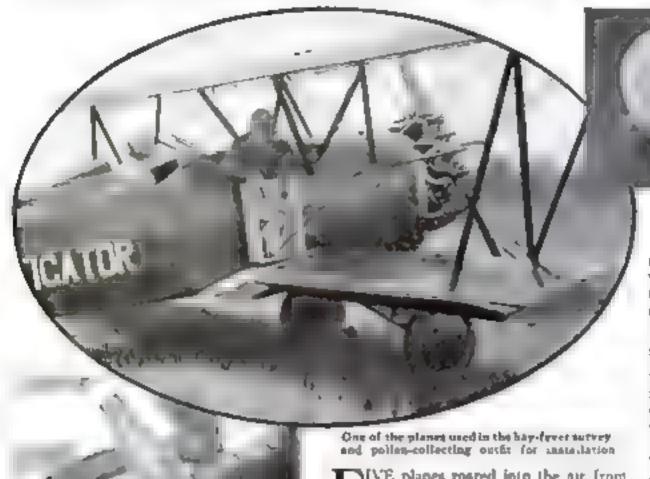
Left, the machine-gus sectedge of the World War, the thirty-seven-millimeter shell. Below, drawing shows how place atmed with taunon would nettrange an ordinary machine gun

37-mm.



To disable a please with a machine-guo bullet, it must be but in one of the vital parts, colored black in this illustration. With an aerial canous, the place would be disabled if a shell hit any part of it

Search Sky for Facts on Hay Fever



FIVE planes rosted into the air from Somerton sirport near Philadelphia, Pa., the other day, to inaugurate a five-year search for the causes of hay fever. The investigation is sponsored by the Philadelphia College of Pharmacy and Science. In daily flights during the hay-fever season, the planes will collect the microscopic, air-borne grains of pollen

What pollen looks like. Samples of the pollen of tomothy regweed, and other hey-fever-producing plants, as magnified 5,500 diameters

responsible for its symptoms, Samples will be taken at each 250-foot level, up to an altitude of 2,500 feet, over an area eighty miles in diameter surrounding Physidelphia and another on the New Jersey coast, Poilen-bearing air, trapped by a funnel-shaped collector on the plane wang, is led through a tube into liquidfilled bottles where it is retained for microscopic identification and counting. Gages in the cockpit show the total volume of air yielding each sample, so that the relative quantity of pollen in the air at various times and places can be compared accurately. The survey is expected to explain the comparative immunity of hay-fever sufferers at the seashore; the paradoxical immunity season of July and early August; and the frequent aggravation of symptoms after sundown. The effect of rain, electrical storms, humidity, and wind will also be determined.

WASHABLE BINDING FOR SCHOOLBOOKS



Cluse-up of the meter that gages amounts of

pir from which samples of police are co sected



This tare make can soor through the air

SNAKE that sones through the air has just been acquired by the Barrett Zoo Staten Island, N. Y. The flying snake, a native of the Malay Pennsula, achieves thight by flattening riself to resemble an inverted trough With its body thus curved. the make becomes a living glider and is able, with the power of its spring, to burl itself over surprising distances. It is one of the few of its kind ever brought to this country and is considered a valaable addition to the zoo s codection.

NTENDED to help prevent the spread of infections among school children, a recently developed textbook building can be cleaned with soap and water or washed with disinfectants without damaging either the binding or its color. The basis of the new binding is a cotton fabric This is impregnated under pressure with a waterprooting compound of pyrazylin, a substance derived from cotton and used as a basis for lacquers. The binding, in addition to resisting water and stains, also protects books from the attacks of destructive insects. Being stronger than the usual binding cloth, it is said to increase the life of much-used books.

Left, inserts show sample of old hery bonding, and of the new material after exposure to meets. The new binding is unknowed

Below, test demonstrates the waterproof quativita of the new binding. It can be washed with soap and water without damage



The Man OF WITH the Net

A DRIVEWAY with tellers is provided by a bank in the west so motorists can make deposits without getting out of their cars.

ALL THE SALT in the occurs would cover the United States with a layer a mile and a half deep.

WHEN ASKED to pick any number between one and ten, most people pick seven.



ONE-FIFTH of all the people accidentally billed in America die in accidents coused by pear vision.

A MAN can read a newspaper by the light produced by a Costa Rican Lautern Fig.

MORE substances will dissolve in water than in any other liquid.

OUR EYES are only one star in 5,000,000



RUSSIA has the most children; France the most old people. Almost fifty percent of the people in Russia are under twenty years of age. Thirty-one percent are under twenty in France, thirty-nine percent in the United States.

PURE St. VER is used to hell bucteria in a German swimming pool. The disinfectant is formed by mixing one part silver in a quarter biliton parts water.

THE AYERAGE thundercloud holds about 1/200th of a cent's worth of electricity.

THE FIRST gold ever obtained from the aky was mined from a stray meteorite recently found near Malrots, New Mexico.

SACCHARIN, 300 times as sweet as sugar, cames from coal tar.



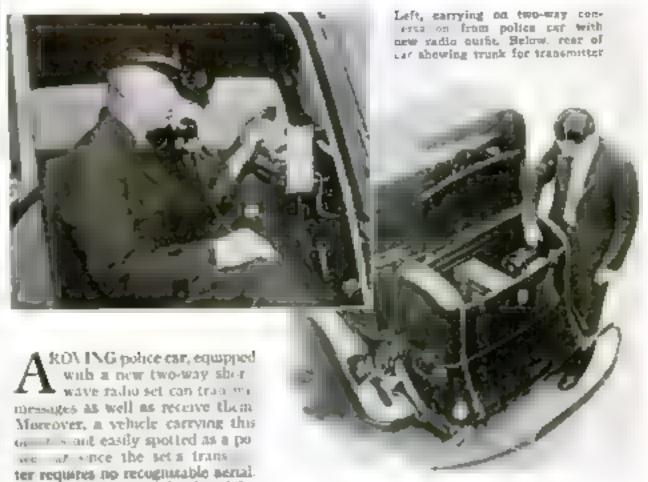
FARMERS in Southern California are adding plant fond to irregation mater. Ammonia gas in the motor has proved as nourishing as altragen fertilizer

CHICAGO is userer the center of the earth than New Orleans

COLUMBUS had frechies. According to a recourty discovered book, written twenty years after his death, he was also "big," "sharp-syed" and had a "inng red face."



TWO-WAY RADIO SET FOR POLICE CARS



and rests on rubber cushions to eliminate shock. The receiver is mounted under the dash. Instead of a speaker and microphone, the new radio uses a standard hand telephone set. This is carried on a hook mounted on the dashboard.

CARVES MODEL SHIP ON WOODEN WATER

models, carved by Andrew Axel, a reisred Los Angeles sen captain, have wooden sails and plow through wooden oceans. The captain, a skilled marine artist, paints his own sky and cloud backgrounds for the model ships and colors both ship and the wooden water in natural tones. Only half a ship is actually modeled. This is oil-painted back

The role of antenna is played by

the rear bumper, which to all appearances

is port of the car's standard equipment

At one end, the bumper is insulated from

the car by fiber washers and at the other

end it is grounded to the car frame. The

transmitter is concealed in the rear trunk

ground, and the water, carved in fine detail upon a six-inch piece of wood, is fixed to the bottom of a deep frame. The frame is then set over the completed model. The



glord down upon the Remarkable ship model under full sail on 4s occan curved from wood

effect is one of complete realism. The captain has produced hundreds of models of this kind, including one of President Roosevelt's yacht, Amberiack II

WEDGE ON HAMMER PULLS NAILS

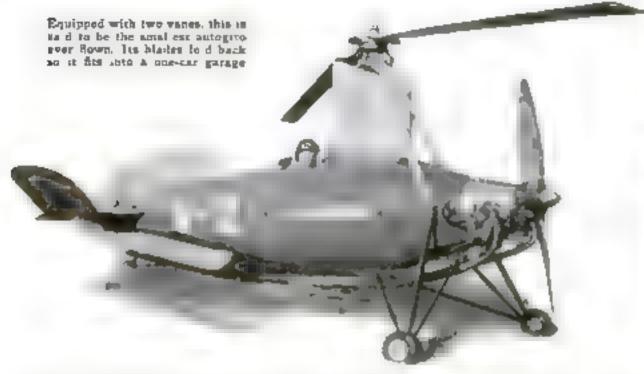
RECENTLY devised by a Des Moines, Iowa, inventor, a new hammer requires no block of wood thrust beneath its bead in drawing long nails. A triangular extension of the head serves this purpose, increasing the leverage of the handle and also, it is claimed, pulling



a nail out straighter than is possible with a conventional tool. The top of the triangle is knurled to prevent slipping. The inventor also has developed a wedgeshaped attachment which converts an ordinary model into one of the new type.



TINY AUTOGIRO FITS ONE-CAR GARAGE



SMALL though to be tucked into a single-car garage, a midget autogico, that recently completed its test flight in England, is said to be the smaltest ever built. Unlike larger craft of its type, the midget's rotor has only two blades, which can be folded back to save hangar space. The power plant is a small two-cylinder en-

gene. Since it is easy to handle, the mulget autogure is expected to prove popular as a private airplane. Should demand make it possible to produce the thip in quantities, it is estimated that the cost would not exceed that of a medium-priced automobile. Like other autogros, it does not require a large space for landing





TWO PAIRS OF GOGGLES ARE COMBINED IN ONE

Two PAIRS of goggles are combined in a new convertible model. Tinted lenses, for welding, may be pushed out of the way when not needed, permitting the heavy inner lenses of clear glass to be used alone for chipping or other hazardous operations. The case of making this adjustment removes temptation to risk going without goggles, rather than change them





VALVE FOR HOSE OPENS AND CLOSES ITSELF

An incentous new valve, built into a flexible nozzie for water or air hoses, starts the flow when the nozzle is flexed and stops it when the nozzle is allowed to straighten, outomatically preventing waste. When used with a radiator filing bose, as above, it also ends spuishing and dripping and permits a boiling-bot radiator to be filled from a safe distance, eliminating the risk of scalding the hands and face.

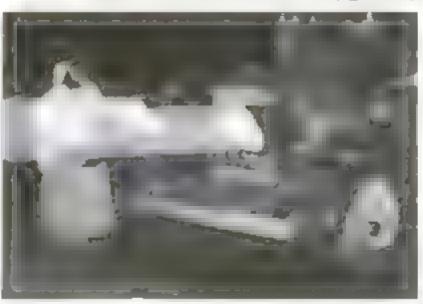
MINERS STAGE ROCK-DRILLING RACES

With intererest increasing in metal mining, the sport of hand rock drilling contests has recently been revived in the West. Ga hering at Idaho Springs and Boulder, Colo., crowds recently watched tourna ments in which miners armed with tough drills and heavy hammers, bored holes in huge stabs of native rock. The winner of such a contest is the man who cuts deepest hole in ten minutes. In "single jack" drilling, the contestant works alone, holding

the drill with one hand and striking it with a hammer beld in the other "Double jack" drilling requires two men, as illustrated, one to guide and turn the drill and

the other to swing the hommer. Each half minute, the men change places. So expert are some of the miners that they can change places without losing a second.

COVER CAR'S HEADLIGHTS IN AIR RAID



Tubes used to mask auto's headlight during a muck aur raid

To MASK the movement of automobiles while A mack air raid was in progress on a recent hight in Tokyo, Japan, drivers were required to equip the headlights of their cars with blinders. The hoods devised for the purpose resembled the sawedoff ends of torpedo tubes. Cut obliquely, they effectively prevented the headlight rays from being seen from above, confining the light to the road ahead of the vehicle, Preparations for the raid were elaborate and conditions of warfare were sunulated with great tourism.



Top, etream ined form, and bottom, consists air current to show wind resistance

SMOKE AIDS STUDY OF STREAMLINE PRINCIPLES

PRINCIPLES of streamlining are strikingly demonstrated by an exhibit in-stalled recently at the Franklin Institute in Phradelphia, Interchangeable models of various sizes and shapes, whose wind resistances are to be studied, are mounted on a stand placed before the discharge orance of a wind tunnel. When a stream of chemically generated smoke is released into the air stream, the eddies and turbulent air currents created by non-streamhaned designs, which cause air drag upon airplanes and automobiles in motion, are made clearly visible. With proper lighting the apparatus also lends keelf to unusually clear photographic studies, as shown in the two examples above. One reveals the smooth flow of air around a streamlined form, and the other the swirls and eddies about a cone



LAMP ENCIRCLES TOOL

Using a ring-shaped lamp bulb, a new flash light recently developed in Germany furnishes illumination for a score of delicate tasks. The strange bulb resembles a short section of pipe, with the filaments contained within the circular walls, and its central hole serves as a socket for a pencil, surgical knife, pincers, or screw driver. Thus the beam of light always follows the instrument, assuring perfect illumination, as shown above.





A V Muszey with goggles, and his ground assistant exhibiting a suck of eggs lowered to earth, and a live of olich has adaloft in a successful test of the flyer's new pick-up system

New Pick-up System for speeding planes



Diagram at selt shows how the plan works. I. Starting to lower the cable 2 Lengther on called taken spira form, its away narrowing may the and. J. Plane at 1 size ing with end of cable on ground. 4. Lefting the coad.

SCIENTIFIC atunt devised by a western aviator, makes it possible for an airplane flying a quarter of a mile high to pick a man off the ground and haul him safely aloft. The scheme is proposed as a means of rescuing castaways, stranded explorers, passengers on sinking vessels, and any others cut off from ordinary aid. In addition it would permit dropping or picking up mail and supplies of any kind from the air.

The pick-up plane circles lazily high above the chosen spot and a long, weighted cable is lowered. It first bows outward, but as it lengthens it assumes a spiral, or corkscrew, form due to air drag. When the weighted end reaches earth, it is swinging in a circle of less than ten-foot diameter. Thus it can easily be grasped and fastened to any desired object. The plane, gradually straightening its course, bauls up the cable and the load attached to it, and thes on.

A. V. Muzzey, veteran barustormer and originator of the novel pick-up idea, recently demonstrated its feasibility in a practical test at Tuba Okla, Circling an air field at 1 500-foot altitude he lowered a sack of eggs safely to the ground and hauled aloft a live chicken that a ground assistant attached to the cable in exchange. A fivepound sack of sand served as ballast for the end of the cord, and a red bothing suit made a conspicious marker to aid the pilot in lowering it accurately. Later, he and an observer repeated the stunt by dropping and picking up a 100pound sandbag. A hand wurch was used to handle the cable in these tests, but Muzacy plans to equip a plane with a power winch driven from the craft's motor before attempting to duplicate the feat with human freight which he maintains is entirely practicable.



Artist's sketch shows how archic explorers might be rescued or supplied with food by a plane.

How to Build a "Sky Globe"

WHICH POINTS OUT ANY STAR YOU NAME!

TARS and the principal star groups are learned ensiest by having a star-wise friend

point them out to you.

"There is Vega," he says, pointing at it with his finger. "With the little group of five fainter stars near it, it forms the constellation called Lyra, or the lyre. And there is Regulus, the principal star in the

group called Leo, or the lion."

But in case you haven't a friend with star lore, the next easiest way is to use a sky globe. With its aid, you need to know nothing about the stars in order to find all the principal ones. The sky globe will point them out to you infall-bly and show you just what their constellations look like in the sky at any time of the year.

The sky globe is almost as easy to build as it is to use. You begin with a cheap geography globe such as is sold in stationery stores, I used one five and onehalf inches in diameter that cost twentyfive cents for the model shows us the photographs. It is made of hthographed tin, but one of cardboard would have done just as well. When you obtain the globe from the store, it will be mounted either in a semicircular frame attached to a base, or on a stiff wire axis which is twisted below Into a ring upon which the globe stands.

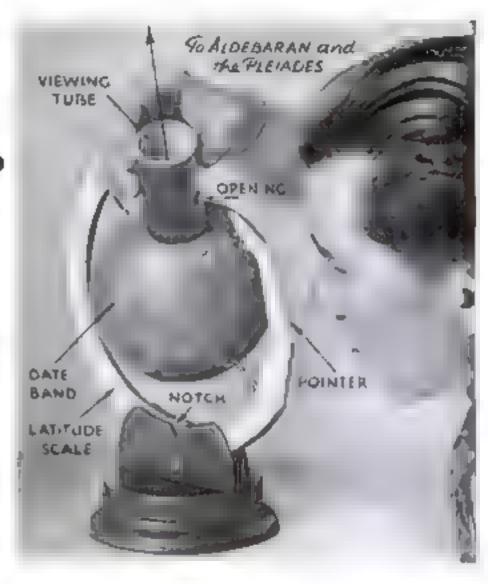
In either case, the globe must be remounted in.o a standard which will allow the slant of its axis to be adjusted in accordance with the latitude of your home

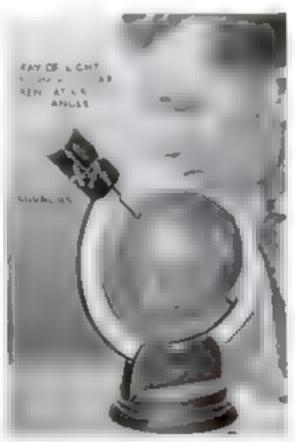
The semicircular frame and its supporting pieces can be cut with a scroll saw out of three-ply paneling. A small bolt through the supporting pieces serves to clamp the semicircular piece in position at the correct slant. A notch cut in one



ByGAYLORD OHNSON

When the globe to set with the pointer at the current date on the equator band, and the viewing take is pinced at the proper point on its surface. the star or constallatten you wish to see will appear through the hole at the side Since Iwo murrors ore used, the star groups are not reversed in the image, but appear in the same position as if viewed directly





SETTING GLOBE BY POLESTAR

Above, testing the adjustment of the sky globe by placing the viewing tube in line with the polar same and looking for the polaritat in the mirror Left, the viewing rube detached from the place to about the stud that is inserted in hales punched in the globe at the positions of the stars. The stud projects about half so inch of the outside supporting pieces reveals the latitude figures as the frame is slid in its supports. The circular base is easily turned out of plank on a lathe or it can be left square if no lathe is available.

The axis of the globe turns in two small holes drived edgewise through the wood of the semicircular frame. In the case of the sheet-metal globe which I used, if a original axis consested of two half-inch stude riveted into the sphere at its poles. I left these undisturbed, and extended them by soldering on two large brad nails while the globe was held in position, with the nails resting in their bearings. If you use a posteboard globe having a continuout wire as an axis, the wire of the base support can be straightened out and enough of it used to extend the axis. The upper end of the axis does not extend entirely through its hole in the semicircular frame. The upper balf of this hole is left as a socket for a stud on the bottom of the viewing tube. This stud can be made from a had of the same diameter as the axis were of the globe.

The lower end of the semicircular frame is extended through another quarter circle and filed sharp to serve as a pointer for indicating the dates lettered along the sky globe's equator

When the frame and base are complete, and the globe is fastened upon its axis, you are ready to make its aky-map covering and glue it upon the spherical surface.

The length of the date band along the equator should be three and four-teen bundredths times the diameter of the globe. With the five and one-half inch globe I used, this was seven-teen and one-fourth inches.

The sky-map covering for the globe can be copied and enlarged to the correct size from the diagram pian shown with this article, by photography or with mechanical drawing instruments,

When you have made your emarged paper map, the next step is to cut away the waste paper from between the gores of the pattern. You can either cut out each gore

separately, or leave them all attached by the date band running across their middles.

Then give the gores into position on the globe's surface. Attach each glue-covered gore first at the equator and then smooth on gradually toward the poles. You may need to make a few anips with schoots along the edges of each piece, in order to smooth the paper down flat upon the curving surface. You will also need to cut the pointed ends to fit around the axis at the poles. After the glue is partly dry, an Ivory paper knife belos to iron out little irregularities along the scares.

When the globe is covered smoothly, take a sharp center punch and drive a small hole through the center of each large white dot which represents a principal star. These holes should be just large enough to fit the nail stud which protrudes from the bottom of the viewing tube.

One more thing remains to be done be-





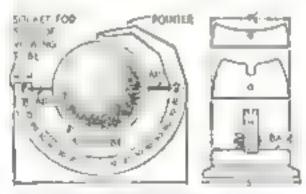


If the sky globe were to be used at the north pole, it would have to be ad used like this, with the lettere figure ninety degrees

In the latitude of Buesos Arres, South America, the globe would be set with its northern axis tilted thirty degrees below horizontal

If used on the equator (latitude sero degrees) the globs would be set with its axis bornontal, the figure O appearing in the notch.

fore the sky globe and its supports are complete. You will need to add a latitude scale to the semicircle. This can simply be copied from the protractor in a drawing instrument set. It is numbered in both directsons, from 0 degrees at the equator to 90 degrees at each pole. When this is lettered on Bristol board, it should be glued to the wooden frame as shown in the photos. Then set the circle so that the figure corresponding to your latitude



Plan for making globe frame and beer. The laterade usale is drawn upon Bristel board

appears in the notch on the support. The globe now turns freely in its support, with the date band along the equator running under the pointer. As you turn the globe over from right to left, counterclockwise, the dates succeed each other in calendar order.

Place the correct date under the pointer and the upper half of the sky globe will then indicate the positions of all stars above the horizon in your latitude at 9 P.M. on that date. If you are observing at 10 P.M., bring a date fifteen days later in the year under the pointer. You can do this because there are twenty-four of these fifteen-day divisions; each one is therefore equal to an bour in the day. The appearance of the sky at 10 P.M. will accordingly be the same as the appearance fifteen days later at 9 P.M.

In the same way, the smaller divisions, labeled 20, 40, and 60, can be used either as five-day intervals or as twenty-minute intervals. To illustrate. Turn the globe until the pointer (Continued on page 129)

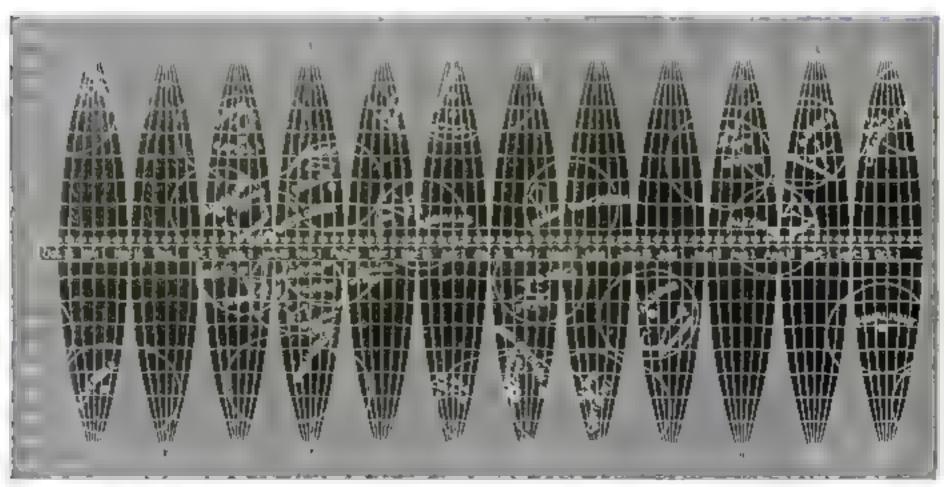


Diagram plan showing how to lay out the star map for your globe. The twelve gores are cut spart and glued in order on the sphere

O SHOW what projected structures will look like when completed, a Southern California architect and real estate dealer has devised a way to make fauthful small-scale color reproductions of huldings out of cardboard, ceduloid, and liquid rubber. The cardboard cut to scale, is glued to a balsa wood frame to form walls, cornices, balcomes, grilles and doors, Rafters, trellises and columns are also fashioned from balsa. Celluloid is used to represent window glass. After being scored with a metal point, it is brushed with ink. The ink remaining in the etched lines after the surplus has been world off gives a realistic appearance of window panes. Tile roofs for the models are made from liquid rubber. This is poured into they molds and,



Imitation window passes are made by scoring cel uto 4 and brushing inh spio the lines formed

MODEL HOUSES MADE OF ODD MATERIALS



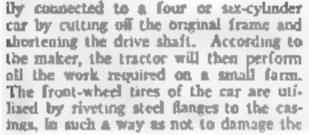


VACUUM CLEANER USED ON STREETS OF CITY

Ax mnovation in street-cleaning equipment is a motor-driven vacuum cleaner just introduced by the Middlesex, England, County Council. Illustrated above, the machine resembles a garden cultivator, with four supporting wheels and long handlebars. The powerful vacuum blower is driven by a small gasoline engine which is mounted directly upon the cleaner Fuel for the engine is contained in a tank between the handichars, and a throttle attached to one grip, as on a motorcycle, controls the power of the suction. Dut sucked up by the cleaner is blown into a container at the back of the machine,

UNIT TURNS OLD CAR INTO A TRACTOR

TURNING an old automobile into a serviceable, crawlertype farm tractor, at a cost said to be less than that of an average team of horses, is made possible by an mexpensive conversion unit recently placed on the market. The attachment comprises a pair of endless tracks mounted on a frame, and is eas-



ing of the engine.

An old car with conversion unit operat-

ing as a serviceable

farm tractor Note

the flagger attached to the forward tires

inner tubes. The flanges tend to haid the machine to the furrow, assuring straight work in soft ground. No changes in the power plant are required except the addition of a heavy-duty air cleaner to prevent dust damage, and in some cases increased fan speed for more efficient cool-

TYPEWRITER ALIGNS LEDGER ENTRIES



SELECTING the proper columns for making bookkeeping entries is a task performed automatically by a dial on a new German typewriter. The unusmally wide carriage of the typewriter takes a wide ledger sheet with ruled columns. To align any one of these columns for making an entry, it is necessary only to use one of the corresponding finger holes contained in the dial. A toothed bar on the front of the typewriter carries attachments for totaling up the columns, and an extra row of keys bears the special symbols required.

Stalk Sea Monsters in Odd Craft

Mysteries of the Deep May Be Solved By New Invasion of Submarine Caverns



will be added to hold it steady in submarine currents, and a tractor tread is under consideration as a means of crawling along the ocean floor. Wooden framework may also be installed to prevent the thick quarts windows from shattering in the event of a codssion with an undersea crag-an accident that would flood the ball and mean certain death to the occupant. With his "submarine charlot," Dr. Beebe plans to invade submarine caverns and grottees on the ocean floor, hoping to obtain a better view of enormous, fantastic creatures he believes he has dimly glimpsed in previous descents.

ANNING undersea observation posts that employ the strangest of mechanical equipment, naturalists soon will attempt to solve perplexing mysteries of the deep. J. E. Widlamson, pasteer photographer of life beneath the waves, will stark the famed "sea monster" said to inhabit the waters of Loch Ness, Scotland, with the aid of his submarine exploring tube. Thus be plans to settle the controversy as to whether the creature is a sea serpent of fabulous size, as some observers insist; a large whale, as naturalists have tentatively identified it from long-distance photographs (P. S. M., July, '34, p. 18); or, as Williamson himself proposes, a buge squid that, in its infancy, may have entered the loland lake through the narrow channel that connects it with the sea-From the deck of a drifting boat, he will descend an open-mouthed, junted steel tube to an observation chamber bung at its bottom, where he will peer through a porthole for signs of the monster. Williamson hopes to get a close-up photograph that should show exactly what it is,

Meanwhile Dr William Beebe noted explorer and bolder of the world's deep-sea diving record, plans to remodel the water-tight metal globe or "bathysphere" in which he has descended more than 2 500 feet below the surface. Fins and a tail



Above, bathyaphere in which Dr. Boebe made his record descent. Shouth shows how it may be firted with a tractor tread.

Left, how J E Williamson, updersea photographer, plans to stalk the "monster" of Loch Ness with his submarine observation tube. He believes it to be a buge equid



PHOTO DEVELOPING TANK IS OF STAINLESS STEEL

Especially muted for the new grainless developing process (P.S.M., Oct. '34, p. 78), a new tank of stainless steel permits photographed film to be wound on the reelwithout the use of a protective aprop Being welded, the tank is perfectly smooth inside and out. It must be leaded in the dark, but light may be used in pouring in the developer. The stainless steel prevents fogging which occurs when film being developed by the grainless process comes into contact with ordinary metals.



Its squat design suggesting a helmeted knight in armor, a streamlined motor truck is England's latest contribution to fast highway transport for freight and express. The angles, jutting fenders, and straight lines typical of ordinary trucks have been eliminated in an effort to lessen wind resistance and thereby increase speed. Trucks built along the new lines are also said to take less road room than do conventional trucks of like capacity The unusual appearance of the new streamlined truck, as viewed from the front is shown in the photograph at the right Note the absence of all air resisting projections found on most trucks



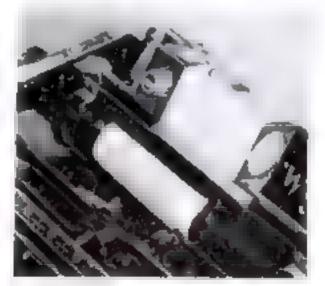
WRECK BENDS RAILS IN TWO-TON HOOP



Buel hoop formed by three rails which were plowed up and twisted by the Impact of a waveled train

A DEBAILED express train can bend massive steel rails into a hoop as easily as a basket weaver bends a reed, as a recent freak accident showed. When a Pennsylvania Railroad flyer speeding from Washington to New York left the track near

Bristol, Pa., the coaches bumping along the crossues, ploughed up three rails and twisted them into the giant ring pictured above. The twisted rails made a circle nearly thirty feet high. The steel in the grant boop weighed more than two tons.



TYPING OF LABELS MADE EASY BY NEW PACKAGE

An incentous new package permits continuous-roll labels to be written on an ordinary typewriter without special attachments. The package contains a roll of gummed paper, rouletted to form 250 labels. To start the roll through a typewriter, the package is laid upon the paper rest of the machine and the platen turned After a label is typed, it is easily detached from the roll. The portion of the rol. drawn from the package but not needed may be rewound on the roll

FUSE TELLS WHEN IT IS BURNT OUT

THE necessity of unscrewing every tuse in a box, to locate one that has blown out, is elimmated by a recently



The sign changes to "NG" when turn burns

marketed fuse. When the fuse is in good order, the letters "OK" are visible through a peep hole in the cap. When the fuse burns out, these letters disappear and the sign "NG" takes their place. Danger of shock in removing the fuse is obviated by two non-conducting porcelain knobs.

VACUUM HOLDS AUTO LUGGAGE CÄRRIER

A NEW auto lurgage carrier is attached by merely laying it upon the roof of the can be converted into a table.

car and connecting a piece of rubber tubing to the vacuum line of the windshield wiper. The resulting suction causes four vacuum cups on the legs of the tubular steel frame to greethe roof firmly and held the carrier in place. When the engine is shut off, automatic check valves in the fine maintain the vacuum. The carrier is large enough to hold ten suit cases. The carrier also,

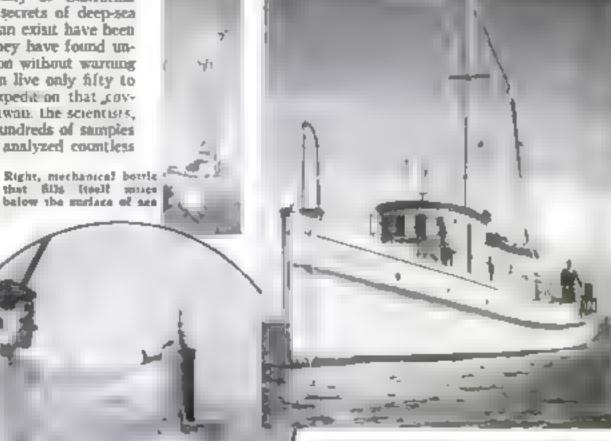


Suction from intaka manifold holds laggage carrier in place

Strange Robots Explore Ocean Depths

the sea are revealing, for University of California occanographers, new and amazing secrets of deep-sea life. Great watery deserts in which no life can exist have been discovered by the mechanical assistants. They have found unsuspected currents that reverse their direction without warning and have brought up strange plants that can live only fifty to 100 feet below the surface. On a recent expedition that govered a route from the Aleutian Islands to Hawan, the scientists, with the help of the mechanical aids, took hundreds of samples of sea water and minute marine life. They analyzed countless samples of bottom oose and took frequent

temperature reasings. The water samples were taken with strange bronze bottles. These containers, fastened top and bottom to cables, were lowered to the required depth. A lead washer, or "messenger," was allowed to all de down the cable. The



Survey boat used by scientists of the University of California in studying ocuse life and currents. It is equipped with elaborate devices

messenger disengaged the top attachment and let the bottle turn end up, taking a sample of water and then sealing itself again. Odd inverted cones of canvas were used to bring up samples of minute sea life, or plankton. The cones were carried to great depths by weights, where they filtered the organisms out of the water and brought them to the surface. Specimens of the ocean floor were gathered with the help of miniature dredges with faws like opened clam shells. With the aid of these appliances, the scientists have obtained a comprehensive picture of the forms of ocean life.

MAGIC IS HOBBY OF U. S. OFFICIAL

Above, conical per

bring ng up tiny sea

enimels, Left, jou-

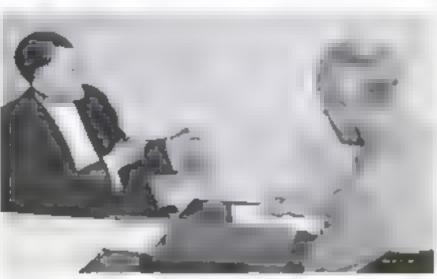
or ng o dradge that bites sample from

the foor of the sea

AFTER a day of concentration upon the realities of figures, William W. Durom register of the U.S. Treasury in Washington, finds relaxation in magic. Durbin has devoted his spacetime for fifty-eight years to this hobby

and has mantered 3,000 conjuring tracks blany of the most mystafying filusions practiced by professionals were originated by this skilled amateur. For giving performances, he has built his own theater, seating 125 persons, on the laws behind his

> home. Durbm's magical equipment is no extensive that the cases and trunks containing it fill two large rooms. For the last ten years, he has been president of the International Brotherhood of Magretans. an organization in which 5.500 magn crans living in every country in the world. bold membership. He won this unusual bonor as a tribute to his skill and originality in magic.



Wilstem W. Durbin, register of U.S. Tressory, demonstrates for a friend one of the bundreds of card tricks he has at fager tips



His hobby has wan Durbin the presidency of the International Brotherhood of Magazines

SOLDIERS SHOOT AT CARDBOARD ARMY



A "GHOST ARMY" of cardboard figures ndvanced brough a wooded section near Docheritz, Germany, the other day. Drawn on wires, the effigies provided realistic largets for Reichswehr troops engaged in rifle practice as shown above, and gave the marksmen a chance to test their skill under conditions like those of real warfare



FLAT PENCIL CAN BE USED AS A BOOKMARK

So FLAT and wide that it can be slipped between the leaves of a volume without damaging the binding a newly introduced pencil serves as a handy bookmark. It also provides the reader with a convenient means of checking off interesting passages, as shown in the illustration above, or of taking down notes as he goes along. When he closes the volume, the pencil with its knotted tassel keeps his place until be picks up the book again.



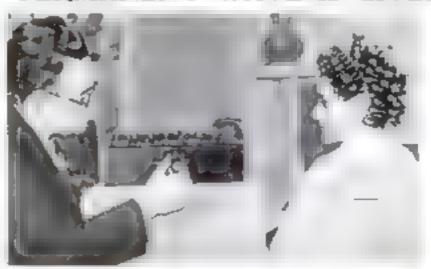
Escalators will be used exclusively to transport customers from floor to floor in a five-story department store now being built in Chicago. Eight escalators will be installed, and elevators will be used only for employees and freight



TOY STEAM LOCOMOTIVE FIRED BY ELECTRICITY

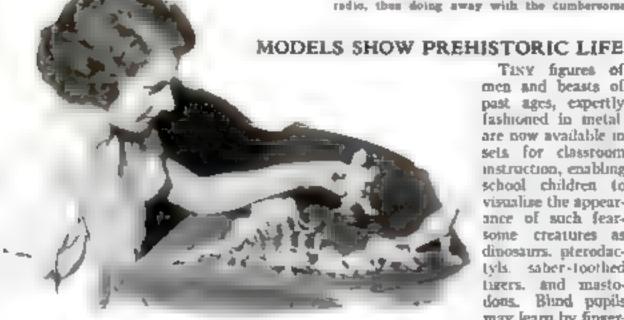
REAL steam, produced safely and without odor, operates a new toy locomotive for 0-gage electric track. When water has been added as shown above, an electric heating element in the boner builds up steam pressure in three to eight minutes. The engine then puffs along as realistically as any boy could demand, starting and stopping as current in the track is turned on or off. One boiler filling is enough for a haif-hour run.

PERMANENT WAVE IS GIVEN BY RADIO



The curlers of this new permanent-wave outfit are bested by radio, thus doing away with the cumbersoms connecting wires

WOMEN can now ohtain permanent waves by radio. The apparatus just developed for the purpose eliminates the heavy electric wires that are part of the ordinary permanent-wave machine, so that the patron need not remain in one spot. Curlers affixed to the hoir con ain heat elements operated by the radio waves transmitted from a highfrequency radio set nearby The temperature of the curiers can be regulated by varying the intensity of the waves.



Prehistoric animals and men modeled in metal for educational and

Tany figures of men and beasts of past ages, expertly fashioned in metal are now available in sets for classroom instruction, enabling school children to visualize the appearance of such fearsome creatures as dinosaurs, pterodactyls. saher-toothed turers. and mastodons. Bland pupils may learn by fingering the figures.



SCREW-DRIVER ATTACHMENT DRILLS HOLES

WHEN books or screws are hard to start, a new altachment for the screw driver comes to the rescue, Slipped over the bade, it serves as a drill to make a preliminary hole with a few quick twists. The attachment fr's screw drivers of various sizes, and is of tool steel.



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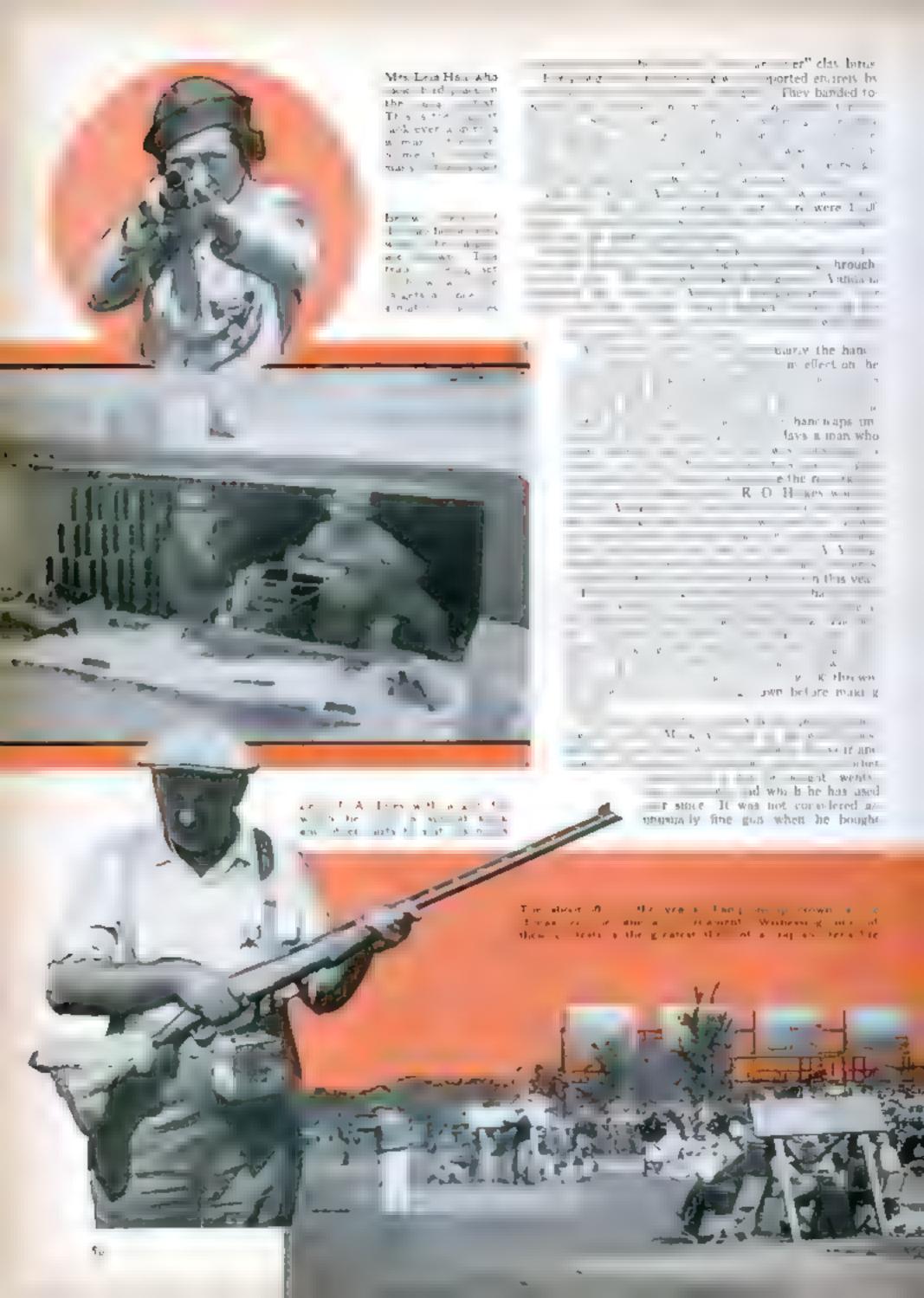
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THEIR CROWNS

Tank of the sixon k and the End tay is yet for a stringer s to the stringer s

By WALTER E. BURTON



it and was priced about the same as other shotguns of the day Yet it has won him about \$50,000 in cash and \$150,000 in trophies during the twenty-five years that he has been using it!

One of the questions frequently in the minds of those who attend shotgun events concerns the origin of the clay-target idea. In proneer days, shooters got plenty of practice bringing down ducks. and other live birds, whether for food or for the sport of it. Then some one conceived the idea of releasing live birds, frequently wild passenger pigeons, from coops and shooting at them as they attempted to fly away. Kuling birds with a shotgun seemed humane enough to followers of the sport. In almost every case the bird was killed instantly or else missed entirely. Then there occurred

a sudden change in public sentiment, and the shooting of live pigeons was enticised as cruel and was prohibited by law in certain states. So clay targets tossed into the air by spring-operated traps, were substituted, and now are used universally. Clay binds provide all the thribs of actual hunting, and their use has done much to conserve natural game.

There are many things that lend a carnival atmosphere to the Grand American Handicap First of all, there are the twenty-two traps, accommodating 110 shooters at one time. Six of these traps are used for practice, so that the number of contestants participating at one time in a main event is eighty or less. It is impossible to watch all of the traps at

once, so each one bas its little band of spectators. Any and all traps will provide thrills for the onlookers. There is an inexplicable fascination in watching five men shooting in turn at clay targets that rise, at the gunner's shout of "pull," from the concrete trap house. When two targets sail into the air simultaneously in the doubles matches, interest is even greater. But for real thrills, there is noth ing to surpass a shoot-off for the year s championship crows.

Tiring of watching the field being sprayed with lend, the visitor seeks other entertainment. In Commercial Row, representatives of manufacturers of guns and ammunition display their wares, of for easy chairs and ice water, and act as general information dispensers. It is a

tented community resembling a circus side-show Out in front of one tent a horned owl is doing a bula hule. Closer inspection reveals that it is mounted on a vertical zod, which can be awang from one side to the other by pulling a cord. The owl's head is pivoted, so that its movements give the effect of a grotesque dance. But be poses in his stuffed glory not for entertainment, but for the highly uneful purpose of trapping crows.

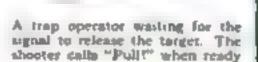
The mechanized owl is being demonstrated by George H. Garrison, representative of a gun manufacturer, who is interested in conservation work. In some sections. Garrison explains, there are so many crows that the existence of beneficial song and insect-cating birds is being threatened. So he sponsors crowkilling activities in such districts. He had the dancing owl constructed for the purpose of attracting crows, an owl being one of the best decoys. While a stuffed owl that does not move will cause crows to congregate within gun range, an owi that dances is many times more effective, he explains, in attracting the attention of curious birds.

Among the most popular attractions in Commercial Row are the shops of several expert gunsmiths who

adjust trigger pulls and perform other repair jobs without charge. It is worth more than the price of admission to watch these experts at work, and they are seldom idle

Most exhibits at the handkup lournament were guns. Many of the trap-shooting enthusiasts, women as well as men, spent hours in specting the hundreds of shotguns on display, and doubtless washing that they had money to buy a dosen of them. Then there were rules. all calibers and sizes. There were treach and riot guns, and even small chromium-plated cannons Inquiry revealed that the cannons are used as signal guns on yachts and eliewhere.

A tour of the gun exhibits was



WHICH EYE IS "MASTER"?

Right, using the manuscope to test a shooter's vision. The object of this test is to measure the dominance of the "manter" eye



51

likely to give rise to the thought that trap shooting must be a costly sport. Several other observations, such as the quantities of shells being carned about by the ammunition hoys, strengthened this impression. Old-timers at the shotgun game were prepared to do some explaining. Trap shooting, they pointed out, is a sport that is admittedly a luxury when followed full scale, but it is not more costly than many other sports.

The man who purchases costly guns and burns up ammunition at a great rate has his counterpart in the golfer who belongs to a club, owns a set of high-grade clubs, takes about 100 strokes for eighteen holes, pays a raddy a dollar for his servnes, and then has to buy dinners for his opponents when he loses. It costs the trapshooter about a nickel each shot. The golfer's expenses are about the same for each stroke

But bow about the duffer who plays public golf courses, carries his own clubs, and finds as many balls as he loses? Where can he find comparable sport in trap shooting? The advice of experienced followers of the shotgun sport is to get a .410-gauge gun and a hand trap that will cost two or three dollars. Shells for the gun run about two dollars a hundred, and targets can be obtained for a half cent each. Any bit of open country

can be used as a shooting ground.

The Amsteur Trap-shooting Association's plant at Vandalia has brought a new industry to the little village north of Dayton —lead mining. A mining engineer would be astonished at the equipment used—a road grader, blowing machine, and melting apparatus. The grader is employed to remove a thin layer of soil from the field in front of the row of traps, and the blower to separate the dirt from the lead pellets. The shot is then multed into 100-pound bars. One of the side-show attractions at the handicap tournament was a stack of these bars, weighing several tons, in the shell house.

It may seem like a waste of time to try to recover shot from a large field. But consider these facts. The last lead mining was done at Vandalia in 1926. Since then it is estimated about 6,000,000 targets have been fired at, including those used in

Ohio State and other competitions held at the range in addition to the G. A. H. Each shell contains about one and one-fourth ounces of lead shot, which gives a grand total in excess of 230 tons. Not all of this will be recovered, but it has been estimated that at least 150 tons, worth thousands of dollars, will be conlected this year.

In all, the Grand American Handitap tournament would be worth the efforts involved in making it possible if it did nothing more than provide concrete evidence of the vastness of trap shooting as a sport, and the grip that it has on gua lovers of the country. The visitor who never before paid much attention to trap shooting is impressed by many things; the size and well-kept appearance of the permanent headquarters plant of the Amateur Trap-shooting Association; the camp, where visiting shooters from all parts of the country erect tents or anchor camp traders; the fact that this is a sport in which a professional can become, without particular trouble, an amateur, and vice versa, a professional being a shooter who is connected with an ammunition company or other commercial organization interested in shooting equipment

The visitor is struck by the fact that contestants will scrape their pennies together and travel thousands of miles to attend the tournament, one entrant coming this year from the Canal Zone. Whole families, each member completely equipped and un expert shot, trek across the continent to Vandada

Inquiry into the normal occupations of the hundreds of expert shooters who take part in the events of G. A. H. week reveal that they represent practically all walks of life. There are doctors, engineers, business men, workers in the trades. This year's champion is an oil driller by profession. Some competitors are better shots than others, but the system of handicapping arranges things so that all stand an equal chance to win valuable prizes. Such prizes are often welcome as means of defraying the expenses of the trip.

That the sport of trap shooting has a tremendous grip to the country is evident. Someone has said that there are 20,000 trap shooters in the United States. The number is increasing These shooters are millions of shots a year and provide em-



Stunts for Home Scientists



PUTTING EGG IN BOTTLE AND TAKING IT OUT AGAIN

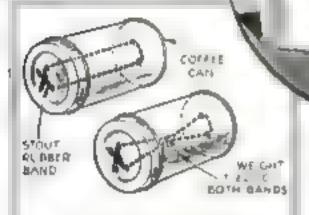
To peet on egg buts a bottle, Brat hard boil it and remove the chell, Light folded there paper and drop it into the bettle. Then quickly turn the bottle on its side and held the egg against the bottle's mosth. It will be drawn lass the bottle op against the egg out, tip the bottle op against your lips so is illustrated. If you blow vigorously the egg will pep per



BLOWING THROUGH A BOTTLE Arrange a milk bottle and a lighted match as shown above if you blow hard against the battle, the match will go out just as though your breath had passed a glit through the bottle.



You can amone your friends with the simple stant illustrated at left. Pleas a flat such its a peol of water and then attach to it as unhighted match. Cover the cork and match with a tembler and lower tuesbler to bottom of the pail. When you take tumbler and remove match it will be dry



CAN ROLLS BACK TO YOU

Punch two holes near the center

of the cover of a good-sund cal-

les can and punch a milar he as.

about an such apart, through the

battam. Pass a staul rubber beed

through the holes and the its ends

together Tie a weight to the

middle of the hand junice the

can. Then as can is rolled along

the floor it will mystify spec-

talura by returning to you

HOMEMADS BOOMERAND

UMBLER

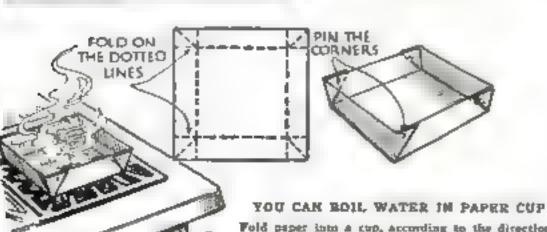
Cut a cross, as shown, from cardboard with the arms doe inch wide and on haif inches iong fitand it up with the front edge of ghtly elevated. If you now flich one arm with a pencil, the boomerang will sail away but at last will

return to your leet, exactly as does the Australian weapon. A boomerang ahaped like the real thing, is shown to the second drawing It also will terute when hipped into the air. Its arms are one tock wide

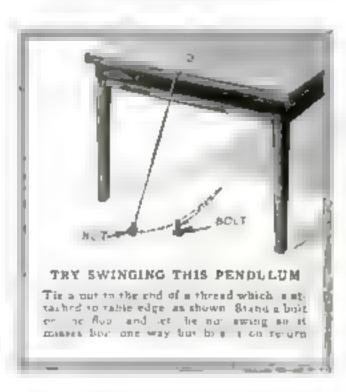


CAN'T BLOW OVER ONE CARD

Your Irlands will be haffed by the sample little experiment: Bund down a half such flap at each and of an ordinary variing card and then stand it on a table. Ask your friends to try to blow it ever. They will find it is conpectable to do this

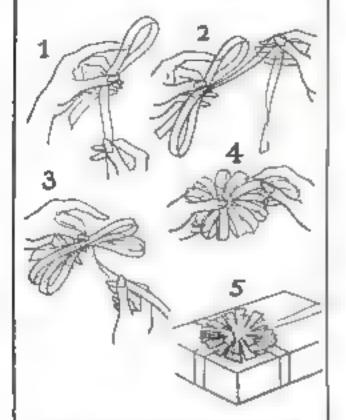


Fold paper into a cup, according to the directions given in admitrations above. Pin the corners securely Fill the cup with water and place it over a gas flame. The water boils but paper won't hurn





How To Tie a Bow with Cellophane Ribbon



Form a loop (1) grasping it firmly with thumb and second finger of left hand. Make a second loop 2 and add two more upper and lower 3) Cut the bow local from the ribbon apod and spread it to a round thape (4. The design may be varied 2) by an point of and of loops after bow is attached.

Neat Cylindrical Packages in Cellophane



Oblong Boxes Are Easily Wrapped by This Method



1 Uncoll a length of cellophane and lay the box upude down upon it so that the top ode will show no joint. Measure off enough to lophane to uncircus the package, plus one lack (or overlap, helding the roll as shown



2 Cut the measured length of cellophane from the roll. Struck the edges together with short patches of Scotch celluluse tape to hold the wrapping in place during later operations. Being transparent, the tape is almost lavaible.



Fold in the aides as with ordinary paper.

Seal all Junts with additional patches of Scotch tape. Cellophane should always be wrapped loosely to allow for abtinkage. Do not puls it too tight pround corners of the package.

Te the package I with ceilophana cibban A bow is to be added at the knot, meanwhere, a single twist of the ribban will hold it in place. The knot may be tied in the middle or at the side of the package. As your artists sense may direct you



The bow made sep-Jarately as shown at the upper left of this page, as placed in post on over the knot. With the loom ends of the ribbon on the package, he the bow in place paing a double knot Smooth out the loops and cut of ands that are long

Analyzing Everyday

IN THE HOME



TRON The process of decision of the process of the

CALORINE GAS Genera



O MAKE use of his knowledge of chemistry, the home especimenter need only turn to his medicine colonet and kitchen shelves. Huncreds of everyday substances offer chemical mysteries that can be solved with test tube and burner in even the simplest of home laboratories.

As a starting point, consider ordinary loundry bluing, sold both as a liquid and as a solid. Usually, iquid bluing is merely a solution of Prussian blue (iron ferrocyanide) dissolved in some organic acid such as oxalic acid. However, it is a simple matter to verify its composition.

First, dilute about a half teaspoonful of the bluing with several times its bulk of water. The professional chemist would use distilled water to avoid impuration, but for the home chemist's purpose ordinary tap water will serve. To this solution add some sodium hydroxide or polassium hydroxide, pouring the liquid drop by drop until the bluing solution becomes almost colorless or water-white. This change in color will indicate that the mixture is in the proper form for chemical analysis.

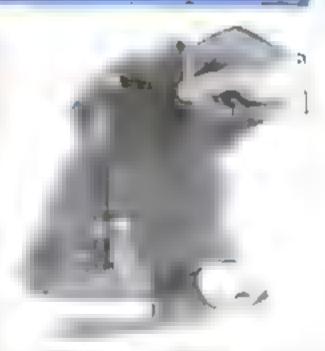
Watch the solution carefully Soon a brown precipitate will be formed in increasing quantities. When this occurs, complete the reaction between the hydroxide and the bloing by boiling the mixture for a minute or two.

The next step in the analysis is to filter off the brown precipitate and wash it thoroughly by pouring or squirting hot water into the filter-paper funnel. Allow these washings to mix with the original filtrate which passed through the paper and save the solution for further tests.

Pour a dilute solution of sulphuric, natric, or hydrochloric acid over the precipitate on the filter paper. This will dissolve the soud and the liquid passing through will contain the mon if any was present in the original bluing. As a final test, add one or two drops of sodium (or potassium) sulphocyanide, If a red color forms, iron is indicated and it is safe to assume that it came originally from the Prussian blue.

To test for the oralic acid, add a drop or two of clear lime water, or calcium chloride solution, to the filtrate which was preserved. If a white precipitate forms, it is in all probability calcium oxalate, indicating that oxalic acid was present instally. This can be confirmed by adding several drops of hydrochloric or natric acid to the liquid. If the white precipitate is dissolved, calcium oxalate undoubtedly was present

Dry bluing, sold in the form of convenient squares or balls, contains neither Priesian blue nor oxabe acid. Instead, it as made by heating a maxture of clay, sodium sulphate, sodium carbonate, sulphur, and sodium sulphide. The presence of the sulphide is easily detected. Simply add several drops of acid to small bits of the solid. Immediately an effervescence or bubbling will take place and hydrogen su phide gas will be liberated. The identity of the gas can be recognized not only by its characteristic odor but also by the fact that it will turn strips of paper, moistened with a lead acetate solution, a deep brown or black. Incidentally, this action of solid bluing provides a simple method of making small quantities of the gas for



BORAX A strip of mode an be used in making butast bead tests. Ordinarily pin numbers is used for this, or sometimes from with

Ordinary toole sait forms another interesting subject for a simple chemical analysis. It, too, is sold in two forms, plain and iodized, the latter containing a soluble iodide. Here again, the home chemist can determine the difference chemically. The test, a novel experiment in itself, consists of freeling the iodine, if it is present, and identifying it by means of some telltale reaction.

To a small quantity of the salt dissolved in water to make a solution, add several drops of starch solution prepared by dissolving ordinary corn starch in water. Then add several drops of dilute chloring water. If a dark blue color ap-

Substances RAYMOND B. WAILES

LABORATORY

pears, iodine is present. The chlorine water for this test can be made by adding daute acid to bleaching powder in a flask and bubbling the chlorme gas given off through a bottle of ordinary tap water. (P. S. M., Oct.

[33, p. 51).

If desired, the test for sodine can he carried out in another manner Instead of adding starch solution, pour a small amount of carbon tetrachloride into the salt water and then add the chlorine water as before If fodine is present, it will be liber ated by the chrosine and will dissolve in the carbon tetrach pride, coloring

This ability of chlorine to free lodine from its compounds, illustrates an important quality of a specific group of a osery rem ed chemical elements known as the hotegous. These elements, the best known of which are chlorine, bromine, and todine, exh bit a marked tendency toward displacement. Character for instance will free or displace both promine and todine from their compounds, while bramine will displace indine but but chlorine. Indine, on the other hand exhibits no ability to displace either of its sister elements.

By using a novel, but easily assembled, piece of apparatus, the amateur chemist can illustrate this action vividly. As shown in the photograph, it consists principally of two small flasks; two large-diameter glass tubes, a long one and a short one, a supply or separatory funnel, some ordinary glass tubang, and a foot or so of rubber tube

The long, large-diameter tube should contain at one end two plugs of loosely packed cotton between which is placed a half inch of solid sodium (or potassium) bromide, Spaced an Inch or so from this set of plugs should be a second set enclosing a half inch of sodium (or potassium) todide. Finally, this is followed by a strip of test paper made by immersing white paper in a solution of starch.

A chlorine gas generalur consisting of a storpered flask having a sup-



PNEUMATIC TROUGH measure gas laberated in tests film the one shown at the left, a sample phenmatic trough can be gr-

ply funnel and contaming bleaching powder is attached to the end of the tube nearest the bromide compound. The other end of the tube should lead to an absortung flask containing a caustic solution such as lye. To make sure that none of the poisonous gases escape into the air, a supplementary absorber, consisting of an unright tube containing small glass beads over which the caustic solution has been poused, should be attached to the outlet of the absorbing flash. The most beads present a large surface to the gases passing through the system and allow complete absorption.

To start the reaction, place

ARCENIC. Marsh's test for arsenic consists of general og hydrogen gas in the presence of the sub-stance being tested. If accents in present, are no gas will be formed and can be identified as shown

some dilute acid in the delivery funnel

and allow it to drip on the bleaching powder contained in the generator, This will liberate chiorine gas, which will pass on to the reaction tube where it will come in contact first with the bromide compound. Passing over the chemical, it will release the bromine which can be recognized by

its red vapor as it passes into the empty center portion of the tube. Being pushed

along by the chlorine entering from the generator, the free bromine will come in contact with the fedine compound stored

at the other end of the tube. As it does, a

purple vapor will be noticed. This is the odine freed from the compound by the

promine. That the gas is fodine will be shown by the fact that it will turn the starch paper a deep blue. Lazative medicines offer the home chemist another field for analysis and interesting experimentation. In most of the candy and gum laxatives, the familiar chemical phenolphthalem is the active ingredient. The test is to identify phenolpathalem a simple one. First make the laxative into a solution by adding it to water and heating. Then filter it. If the filtrate takes on a definite reddish-purple color when a caustic solution is added, phenolphthalein is indicated. Add a

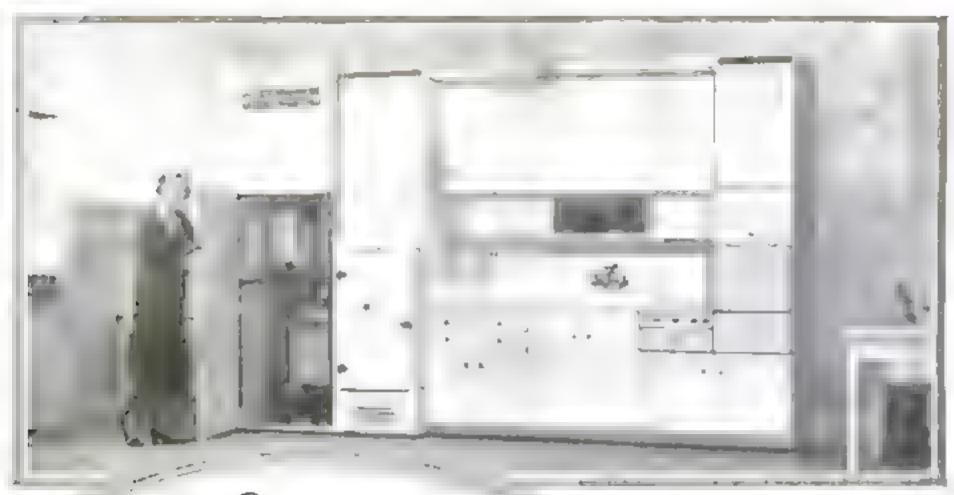
strong acid to the (Continued on page 126)

DECEMBER, 1934

BARING POWDER. It is easy to compare the volumes of gas liberated by equal amounts of various

billing powders. The carbon dioxide gas displaces the

water from the buttle, where its volume is measured



Latest INVENTIONS FOR THE Household

HEATER IN KITCHEN CABINET Conte ned with a the cab net shown above is the heating plant for he entire house, thus doing away with the necrealty for a basement lingual fixed botter is aspet a of heating a neven touch house. It also contains range, refrigerator, and a big sick



DAYLIGHT RULB You can have a daylight lamp numply by a spring over the bush the rap shown above it fitters out yellow rays giving an slum nation that is easy on the eyes. At upper left a vegetable cooker that is said to cook lood without loss of flavor Circulated steam does the work.

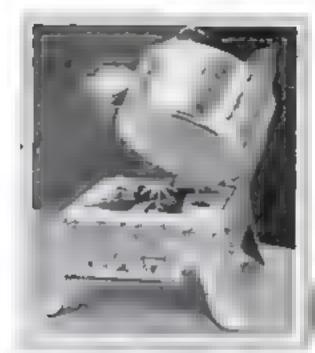






SCRUBBER AND SCRAPER The acrobbing cloth, left, comes with a convenient scraper permanently attached to one corner so it is ready for instant one. The cloth is worth of survey mesh and the acroper is of dayable metal that will not run.

RAIN CLOSES WINDOW The automatic device. Literia: ed above in photograph and drawing, will a one a window of its own accord when rain starts. It consults of a trigger bold og open the window and a lump of sugar. As rain melto the sugar the trigger is released and down comes the window, the sask falling of its own weight



AUTOMATIC GAS PLATE. Provided with a pllot I ght and a volve, this gas burner lights itsoil when a pot is placed over it and goes out when the pot is removed. A movable plunger accust ed by weight of the pan, operates the device







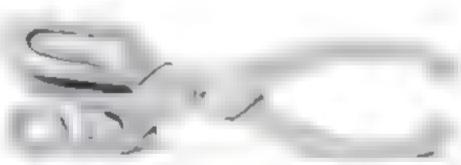


STOOL AND LADDER A seelul accessory for the kitchen is the combination atool and sequedder shows above. As the top is litted, the lower ever fails sutums scally into place. Lowering the top folds up the step. At left, the device is shown with the step closed to change it into a stool

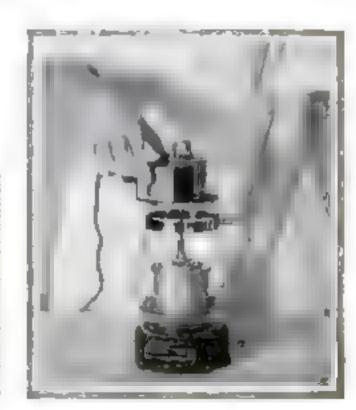
TUB AND WASHITAND COMBINED The greatest possible use of I mived space is made with the unit shown below 11 consists of a bethub and washined combined. The tub is placed to a recess in the base of the washined, along with medicine chest

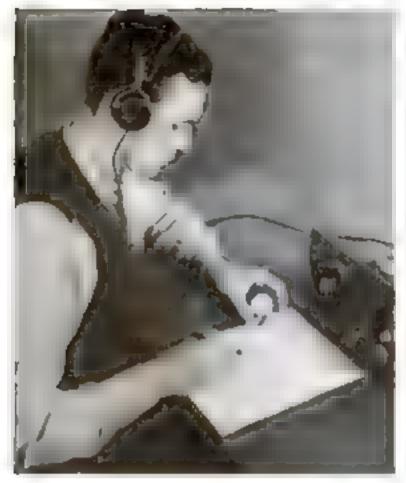


WHIRLS WA-TER TO MAKE COFFEE At right is illustrated a device that makes codes by a newmethod (troutains an electric motor that which hot water through ground coffee at high speed. At the end of three to four minutes a pre-set assomatic timer stops the motors and coffee is ready to serve



CLOTHES LIFTER. Mode of maple and innotated against heat, the clothes lifter makes it unnecessory to burn the fingers picking clothes dut of hot water. It can also be used to feed the clothes into the wringer, thus guard on against possible injury.





All you need to hunt long-delay echoes to a short-wave net

HOUSANDS of short-wave fans are now hunting radio's newest mystery—delayed echoes. Working with noted scientists, they are searching for the cause of weird signal ghosts that often reach a receiver many seconds after the original wave.

These echoes were first reported in 1927 by J. Hals, a scientist living in Norway.

Listening to a code message from the Dutch station PCJJ transmitted on a frequency of 9.600 kilocycles, he noticed that many of the signals were followed by a faint echo or repetition, Trailing the originals by more than three seconds, these echoes differed from the common type caused by radio waves traveling around the globe (25,000 miles), in one seventh of a second, Figured on the basis of clapsed time, they had traveled more than 500,-000 miles, Later, verifications were obtained, some showing echoes that lagged a full balf minute.

At first, it was thought that the long-delay echo was caused by a portion of the radio wave reflected from the moon. But this theory was soon discarded in favor of another which laid the

cause to a concave reflecting surface located bundreds of thousands or males from the earth's equator and formed by the streams of electrons that are thought responsible for our northern lights

To obtain more information about the mystafying echoes, an international search has been organized. Scientists have called on every short-wave fan to cooperate

Two powerful European short-wave stations, GSB at Daventry, England, and HBL, the League of Nations Station at Geneva, Switzerland, are transmitting a series of test programs arranged especially for the observation of long-delay ethics. The signals from GSB are transmitted in a modulated frequency of 9,510 kilocytes (approximately 31.5 meters) every Sun

Hunting Echoes, New Radio Sport

FANS CAN HELP SOLVE THE LATEST MYSTERY

By George H. Waltz, Jr.

day, Tuesday, and Thursday, from 3.25 to 3.55 Å. M., Eastern Standard Time, while the HBL signals are sent out on an unmodulated frequency of 6,675 kilocy-

cles (approximately 45 meters) each Sunday, Wednesday, and Friday from 6 to 6 30 A. M., Eastern Standard Time.

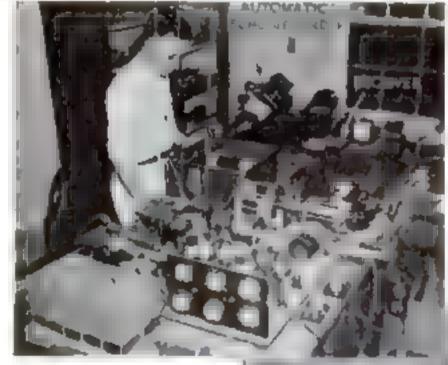
Each transmission begins with a fiveminute tuning period, station GSB using phonograph music and HBL repeating its call letters in Morse code. This is followed by the test, which consists of the letters of the alphabet, sent in order and spaced at time intervals of one minute.

To join in this search, all that you need as a high-frequency receiver, a good watch with a second hand, a pencil, and some paper. The station you follow in your tests will depend on the type of receiver you own. If it is of the short-wave broadcast variety, it will be necessary to confine your efforts to the modulated signals from GSB since the unmodulated continuous waves transmitted by HBL are receivable only by a set having an oscillating circuit.

Once you have adjusted your receiver during the five-minute tuning period, stand by for the letter A. Record the time (to the nearest second) at which each succeeding letter is received and listen for echoes during the one-minute interval between. If any echo is noticed, no matter how faint, note the elapsed time between the original signal and the repeti-

tion, the relative strengths of the original and echo, and any other information you believe

Definger, thief of the racio harmon of the Bureau of Standards in Wasaington D.C. who is acting as the clearing house for reports in the Langed States. State clearly the identifying letter of the signal of served, the one to the nearest second at which the direct signal was recived the time to the nearest econd at which the echo was heard, and or estimate of the relative sitenaths of each



Above a situa of the Sta and Buleau of Sta a do no the study of length delay exhoes it is the exhoes an owner a y

Property of Bresh



有印度有电压处

DOMEST SHOP IN *45 V *96 V * 450 V

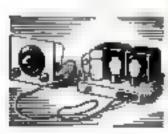
At top, view showing arrangement of parts on the top of the chase a Nove connect one to speaker are made through five-prong plug. Above, underside of the changes

EW pieces of radio equipment prove more valuable to the amateur set builder than a good auxilsary power amplifier. Such a unit is idustrated on this page. It has excelent quality and high fidelity but its design makes it both inexpensive and easy to assemble.

Although little larger than a small receiver, being mounted on a 2- by 7- by 9-inch gluminum thasses and using only three tubes, this compact unit has a varicty of uses. Besides serving as a twostage amounter for a phonograph pick-up. a receiver, or a small public address system it also provides a hum-free power supply capable of furnishing 45, 90, and 180 voits B current and 21/2 voits for a beater circuit

The assortment of simple parts required are listed in the bux on this page Minus the tubes and the speaker, they should not cost you more than \$8 complete.

Looking over the wiring dagram, you will find that the circuit is of the normal class A amphifier variety, making use of a type '57 in the initial stage, a 2A5 in the final stage, and a type '80 as the rectifier. In connecting the socket of the '57 tube the acreen, suppressor and, and plate are fied together, making them function more or less as a single element



and transforming be tube into a triode (tbree-element tube). Al though this causes some loss in signal strength in the input any decrease

EASILY BUILT

AMPLIFIER

Has Many Uses

By WALTER J. BRONSON

What is Needed for This Amphrier

A and B.—Fraed conference, mag., 494 mld. P.—Pewer transformer; rec 241-vals, see C and D.-Freed condensors, Z add., Z voit.

6.- Freed resistor, 800 ohms.

F -Fracel resource, 540 chang G.—Fazad revotor. 200,000 ohmis, i west.

Hamfried consume, 250,000 obms, I wen-.... Pased goodenam, Al mid.

A .- Output transfermer (mounted on aposition 1 L.—Peter thole, 2500 along, M henry

M .- Petrar abobe, 400 ahma, 12 honry. N.-Voltage dissifer 18,880 ohms

Sevolt, and one ISD-volt wonding.

O and R.-Freed condensors, non-industive, I mid.

S.-Tautle switch, 110-volt type.

T see 1. - Electrolytic condensors, 4 mid., 500 yell.

V -Eiertrolytic condenser 4 mld. 160 volt. W -Speaker plug and socket

Y .- Dynamic speaker preferably 2,508-ohis held with neeper transformer (K) mounted on frame.

Missectionerum: One '27 tube, one 2A5 tube, one '86 tube, a Z by 7 by 7 (s., changin, antider, someocring wire, super tack, finding posts, acc.

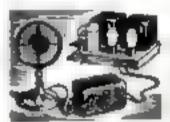
m volume is more than overbalanced by the improvement in tone quality phtained

Shunted across the input grid to the ground, is a 004-mid. mica condenser This is an optional arrangement, but the writer has

found that it tends to improve the tone quality Try the circuit both with and without this shorting condenser and retain the arrangement that gives the best

all-around results.

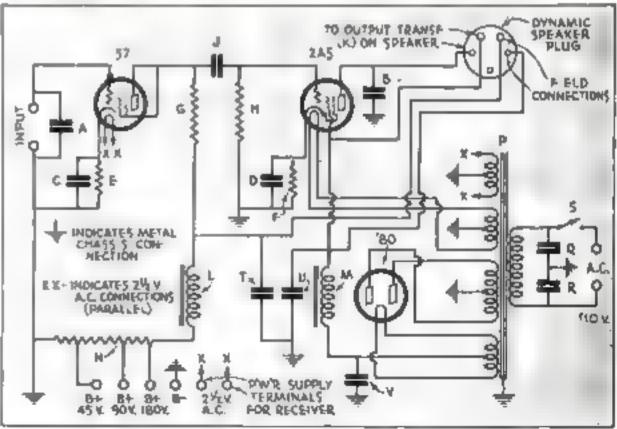
The two .1-mfd. condensers connected into the poweritiput (A.C.) at the power cord also are important items in the cir-



cuit. Although not so important when the unit is used as a straight ampliher, they do improve conditions when the power supply in used in

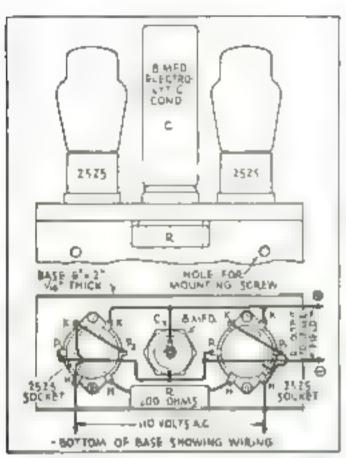
connection with a short-wave tuner.

How the amplifier is used will depend on the unit to be connected to its input. With a small receiver, a grid leak (1 meg.) should be wired across the amplifier input and a condenser (.1 mfd.) should be placed in the wire leading to the grid of the '57 tube. On some receivers, the grid feak can be omitted. A high-impedance pick-up can be wired directly, while a microphone must be used with the usual microphone transformer and battery cir-



Carruit drawing for the emplifier. Compare letters with parts and as given in the box above

Low-Cost Rectifier



Above, wiring diagram and general layout of the small chass a Right, schematic wiring diagram. Note rearms and to a bridge corrust connection

prevented you from making good use of a spare dynamic speaker, you can solve the problem by building the inexpensive power unit illustrated. It can be used as a field supply for a portable public-address speaker or as a power circuit for a remote speaker connected to your regular receiver in the manner recently described in detail (P. S. M., Feb. '34, p. 54).

In districts where alternating current is supposed, a rectifier of name kind must be used to supply the electro-magnetic field of a dynamic speaker with direct current Unlike must units, this rectifier uses two type-25ZS tubes connected in what is called a "bridge circuit." This arrangement, giving full-wave rectification at full dire voltage, eliminates the necessity of

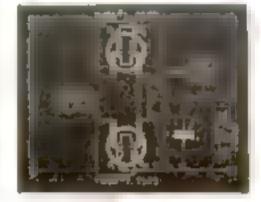
using a power transformer

As shown in the photographs, the parts are arranged on a 2- by 6-in, attendament base resembling a small U shaped chassis. The rear flange of the base should be made deeper than the front flange to provide space for the mounting screws used to fasten the power unit to the speaker baffle board or other convenient surface.

Mounted on the top face of the base are the two six-prong wafer sockets and the single eight-microfarad electrolytic condenser (C) that serves as the filter Under the chassis is the 200-ohm, twenty-watt heater resistor (R) held in place by its soldered connections to one heater prong of each tube.

No difficulty should be encountered in wiring the unit once the various terminals of the six-prong sockets have been located. The combined heaters of the two tubes are connected in series to the alternating cur-

PAUL H. NELSON





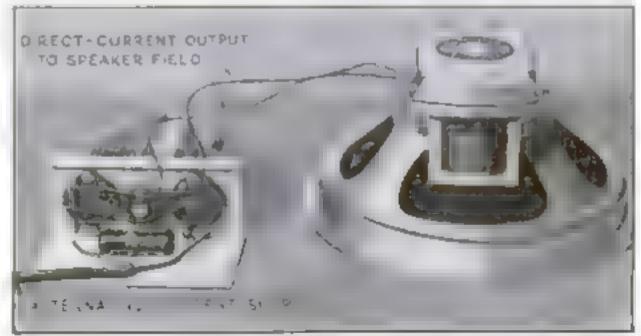
Pront view of the power supply, showing the arrangement of the two tubes and condenser

rent supply and the 200-ohm heater resistor. This resistor reduces the 110-velts supplied to the total of fifty volts required for the heaters (twenty-five volts for each tube). The remainder of the wiring, except for the connections to the terminals of the electrolytic condenser, centers around the sockets.

In connecting the electrolytic condenser, remember that the center terminal is positive while the outside can is negative. The negative connection can be made directly to the case or it can be made to the metal chastes through one of the socket-mounting boils.

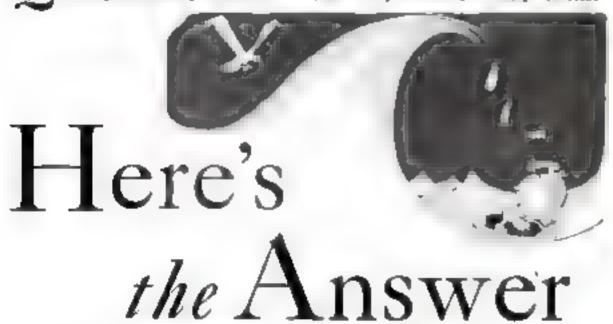
The power connections should be made through a regular insulated cord and plug to the alternating-current supply, while the rectified direct-current output can be fed to the speaker through two wires leading to the field winding. The voice coil of the speaker should, of course, he wired to the output of the receiver or public-address amplifier in the usual way.

Connected to the 1 500-ohm field of a speaker, the unit will supply more than seven watts of almost rippleless power. If desired, the speaker can be fitted with a hum-neutralizing coll to dampen say slight ripple that may remain.



This photograph above how the power supply is connected to the field winding on a dynamic speaker. The power supply cable should be fixed with a plug for connection with a floor plate

What is the height of the greatest ocean waves? G. L. P., New Haven, Conn.



A .- THE RIGHEST OCCUR WAVES SO for toported by rehable observers measured seventy feet from trough to crest

Land-Locked Shark

Q.—ARR sharks ever found in fresh water?
—F J S., Detroit, Mich

A .- NORMALLY, no. However, sharks as wen as other sen fish have been found in Lake Nicaragua la Central America. It is thought that this body of water, once an inlet of the Carabbean Sea, was closed off by a votcanic disturbunce to form a lake. The sea fish present at the time became land ocked and adapted themselves to the changing conditions as the rivers flowing into the lake slowly converted it into a body of fresh water



Cincinnati or Porkopolis?

Q.-- is in true that Cincionati was once known as Porkopoils?--W. E. R., Cincinnatt, O

A .- YES, In 1840. It pained this name by being the best known pork-pucking center in the world.

They Dawdle Along

Q.-now fast do plants grow?-L. K. W., Los Angeles, Calif.

A .- t xout normal conditions, the average plant shoot will grow about 1/100,000 upch second. Thus means a growth of one inch. every 278 hours or eleven and one half days,

World's Largest Teeth

R. K., REATTLE, WASH. An elephant tusk often weighs as much as seventy-five pounds. In reality, a tusk is merely an overgrown front tooth.

It All Depends

Q .- now long most the string on a simple pendulum be to give a period or swing of exactly one second?—H. B., Tampa, Fla.

A .- LOCATION plays an important part in the length of a simple pendulum since it varits with the acceleration of gravity. At New York, a simple second pendulum has a length of 39 1017 inches or 3,2585 feet

Practice Makes Perlect?

T. W. BALTIMORE, Mb. Seven hours of rehearing are required on the average for each one hour radio program. Technicutes and control operators as well as artists must rehearse their roles many tames before going on the air where a slip or lack of coordina-

Old Enough To Know Better

Q .- How out is the carth and how is its

A.-USING B to-called "radioactive time clock method," scientists have determined the age of the earth by measuring the amount of radioactive materials in rock and then figuring its ratio to the amount of lead present. According to latest computations, the earth is at least 1,725,000,000 years old.

Dust and Rain

Q.-to 17 true that if it were not for the dust in the air the earth would be rainless?

-A. Y., Tucson, Arts.

A .- without dust there would be no rain. The minute specks floating in the air provide surfaces on which the tiny particles of moisture condense to form drops of rain. The buzdreds of thousands of dust purticles that fill every cubic inch of air also are responsible for the bright red skirs at surget,



A One-Sided Argument

Q .-- A PRIESO Argues that all sides of the moon have been viewed by astronomers. I claim that only half of the moon's surface has been seen. Who is right?--F H, Des Monnes, Iowa.

A .- over a trifle more than half of the moon, six tenths to be exact, has been seen from the earth. The faz side is never turned toward us because the moon is a satellite revolving around the earth in a fixed position as if it were a bull fastened to the end of A patte of string.

Enough for Billions of Eggs

Q.—now MUCH salt is there in the sea and how did it get there?—L. C. H., Chango, H. A.—soner rive million cubic miles of salt

are contained in the sea waters of the world, enough to cover the entire United States with a layer more than a mile and a half thick. It is believed that primordial sea water was relatively fresh but the quantities of salts and chemicals carried to it by rains and rivers have gradually increased its salinity. It is estimated that more than 63,000 tons of sodium alone are carried to the sea each year

Preserving Leaves

T J., DENVER, COLO. To preserve specimens of tree leaves, spread them smooth and great them flat under layers of hot sand placed in n flat pan. The sand should not be any hotter than the hand can bear. When the sand bas cooled, carefully remove the leaves, smooth them with a hot iron and dip them in varuals consisting of getatin (11 oz.) and contentrated glycena (9 oz.). Finally, allow them to dry. In making the varnah, first soften the griatto in cold water and then dissolve it in the glycerin heated to about 212 degrees Fahrenheit

First Reckless Driver

Q.-with invested the first motor-driven

vehicle?- J F., Detroit, Mich

A .- or an altempt to motorize the French artillery, Captain Cugnot built the first motor wagon to 1769. It was a three-wheeled affair driven by a bulky steam engine. Unfortunately, its life was short. While skyrockeling along a road at the terrific speed of two and one half miles an hour it crashed into a stone wall and was wrecked.



Goldfish Per Gallon

F. T Y., vouncerows, c. In arranging an equartum, it is safe to figure two goldfish to every gallon of water. Globes are not recommended as aquarium containers since they present only a relatively small open surface to the air. If the aquarium is to be placed near & window, one furnishing north light is best. Direct sunlight should be avoided

Winter and Thunder Storms

Q.—way are thunder storms more common in summer than in winter !- Z. L., San Diego, Calif

A.—VIOLEKT storms such as thunder storms are caused by great differences in the temperatures of crossing air currents. Such differences are commoner on the hot days of summer when heated air rises from the earth than in the winter

Warmth from Smoke

Q.—stow on the smudge fires or smoke pots placed in orchards help to protect the fruit from frost?-K. L. P., New York, N. Y.

A .- ir is the heavy smoke, not the heat, that protects orchards from frost. Forming a cloud, it blankets the ground and the trees and prevents the radiation of heat, often keeping the air close to the earth four or five degrees warmer than the starounding atmos-(Continued on page 121)



Gus tells what to do

Gue and Joe pushed and puried until the car rocked back and forth, Suddenly a click was heard from near the floor boards.

When Your Starter Balks

AVE MORRISON setterd himself behind the steering wheel of his car and jubbed confidently at the starter button. Instead of the expected white from the motor, there was a metalise clank and a straining group.

"Now what-" Dave exclaimed belp-

Ned Rogers, who was sitting braide birn, scratched his head. "Never heard anything like that before," he confessed.

"Try R again." But the second try proved no more nuccessful than the first, Only a faint growl was heard. The motor failed to spin-

As a last resort, Dave decided to try the band crank. "It r no use, Ned," he granted, as he placed his full weight on the crank bandle. "I can't even budge her, Seemi like she a frozen stiff. You better run on down to the office before you're late, I'll give the Model Garage a ring and see what they have to say,

When Gus Wilson and Joe Clark drove up in the Model Garage wrecker a few minutes later, Dave Morrison's head was buried under the open bood of his car

"What's the matter?" asked Gus as he swing to the ground. "This cold spell got the best of that motor already?"

Morrison shrugged his shoulders. "Blamed if I know. One thing sure, she won't turn over and all the starter does is groan. Here, listen to it," he commanded, climbing into the driver's seat and holding down the starter button.

"Whoa! That's enough!" broke in Gus plmost at the first note of the groan. "Put her in high gear and let up on that emergency brake. I want to try some-

MARTIN BUNN

thing." As he spoke, he walked to the front of the car and motioned Joe around to the rear

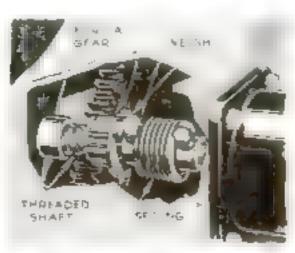
"Now, have you got het in high?" he asked. Morrison nedded

O. K. then, Joe, let's go."

With that, he and Joe began pushing and pulling until the car rocked back and forth in an even swing that almost tossed Morrison from his reat. Suddenly, a loud click resounded from the vicinity of the floor boards.

There," said Gus, "that ought to fix it. Now put her back into neutral and step on the starter again." This time the hum of the starter motor told a different story. The very first touch of the

button set the motor spinning
"I'll be hanged!" Morrison cried, "What



Perspective abowing general construction of the mercia-type scarter drive gent

in blazes was the matter with it anyway?" Cors thuckled, "Inertis gear was stuck," be replied

Morrison looked at him blankly, "What man stuck?"

The drive gear on your starter," explamed Gus. "You know how that works, don't you?" The puzzled frown on Dave Morrison's face showed plainly that he

"Come around here, then, and I'll show you," said Gue as he unlambered the side of the hood and selected a wrench from the tool roll foe had spread out on the riftning board. "First of all, we'll unscrew these two stude that hold the starter motor in place, loosen these switch connections, and take a good look at what's

As Gua worked at the stude, Joe supported the body of the starter motor When the two studs were freed, the motor dropped and Joe carefully pulled its long drive shaft from the hole in the casting that housed the flywheel. The starter looked like any other electric motor except for the shaft projecting at the end.

See this?" Gus asked, polong the shaft with one end of his wrench. "That a what hooks up the starter motor and the feeth on the flywheel. Inertia drive, it's called. Not every car has one, but yours is one that has.

Dave studied it carefully.

"If you'll look," continued Gus, "you'll notice that it's a threaded shaft with a counterweighted gear that runs in the threads, Now when you step on the starter button, the electrical circuit to the starter motor (Continued on page 130)

THE HOME WORKSHOP

SIMPLIFIED

Tesla Coil

Gives 200,000-volt Current for Many Dazzling Experiments

By Kenneth M. Swezey

URPLE streamers of sparks from eight to ten inches long, potentials of several handred thousand volts, beautiful fountains of brush discharge, wireless lights, high-frequency currents that may be taken into the human body without harm and used to perform desens of amazing experiments—all these are at the instant command of the home experimenter who builds a simple resunance transformer or



such high frequency the current I avele on the purface of the body and is not rely pale

of the kind used for lighting neon signs may be used. Used or rebuilt transformers of the latter type may be bought quite cheaply from any neon sign repair company. For home workers who wish to build their own, an article on the construction of step-up transformers will appear in a later issue

A flat tuning coil, consisting of a spiral of about twenty turns of copper or brass ribbon, 1/2 ln. wide and spaced about 1/2 m. spart, with a sliding contact, is perhaps the most compact and easily adjusted. Such coils, as parts of discarded amateur or Navy transmitters may often be picked up in second-hand electrical shops for less than a dollar. A coil simpler to binid may be made by winding a helix of twenty turns of No. 6 bare copper wire on a cylindrical form of notched wooden strips, 8 in. in diameter, with the turns spaced about 36 in. The lower end of the coil should be connected to a binding post. The other connection may be made by means of a spring clip, which may be snapped on the heavy wire at any posifrom retrurred.

Any type of spark gap familiar to the old radio amateur may be used. A quenched gap in preferable where silence and utmost efficiency are desired. A rotary gap is almost as effective. An ordinary straight gap, however, with a small electric fan blowing across the electrodes, will serve

salisiactorily

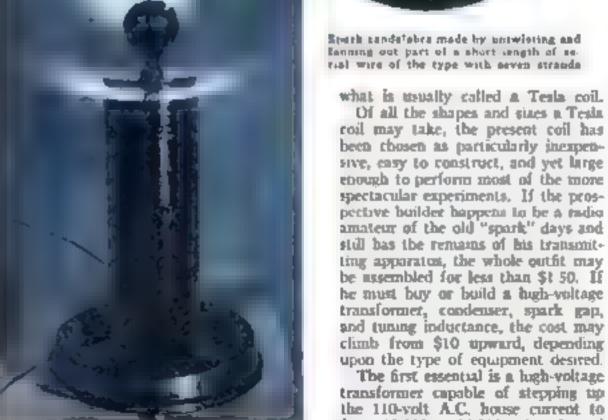
I pon the condenser depends a great deal of the final effectiveness of the entire out-

Spark candalobes made by unswisting and fauning out part of a short length of se-

from £0,000 to 15,000 volts. An old

. or 1/2-kw amateur transmitting

transformer is ideal, or a transformer



Hame-built Tests call in action. It may be used for many remarkable high-frequency experiments



to making the conde cheets of me as for a c fulled down as about of gines chaired with herewon

fit. For compactness combined with man many uses, the high yet age muca condens stands in a class by it self. If the experiment or can obtain a mic condenser with a working voltage exceeding that of his transformer secondary, and a capatity between .002 and .004 microfact 3, his condenser problem in his solver

His next best bet is
to make a consenser
with meta, for and glas
plates. Select four
8 by 10 in photogra, ha
prates that are to
large are but me
strape off the emulsion
after wetting the prates
with warm water Next
cut twenty-eight pieces
of thin copper foil or
heavy tinfoil as shown

Some businers apart the metar for cost in to the plates with she inc, but the serier has had better results with beeswax. Heat the plates gentily in an oven or at a distance above electric grill or gas flame and rub a piece of beeswax over onside of one of the plates until a thin coating has been distributed over the entire surface. Before it cools.

quickly center one of the pieces of foil on the wax coating and press it into firm contact by means of a photographic roller. The lug should extend 1½ in, above the top of the plate. While the plate is still warm, turn it over and apply the wax and foil to the other side, this time attaching the full so that the lug comes up at the opposite side

When seven plates have been completed, bind them tightly together with insulating tape. As a further precaution against brush discharges around the edges, this unit may

be builed for a few minutes in a mixture of one part beeswax to one part rosis, or in one of the compounds made by insulating supply houses especially for the purpose. If properly assembled, seven lags should be grouped at each side. A hole should be punched near the ends of the lags, and each group clamped rightly together with a brass bolt and nuts

The second unit of seven plates should be treated similarly. A wooden spacer, is in thick and the size of the plates, should be placed between them, and the two units connected as shown in series-parallel. If desired, the whole coodenser may be put into a wooden box (built preferably without mails or screws) which has been

with hot wilk en

How to construct the runing of I, condenser and Tests toil proper the wiring diagram and a shatch of an improvised winding device

the terminals led to binding posts on the top

The materials required for the Tesla coduself include a card-board tube, 4 m. in diameter and 13 in long, ½ lb. of No. 28 double cotton-covered wire about 10½ ft. of copper or brass ribbon. 1 in. wide, three ordinary small spools; two

binding posts; corrugated cardboard, ½ pt. insulating varnish, a brass bed ball, a wooden disk for the base, 10 in. in diameter; wooden disks for the top and bottom of coil, dowels, glue, and tape.

Because of the tremendous voltages produced, great attention must be paid to insulation. All the wooden parts and the cardboard tube abould be thoroughly dry and treated with several coats of air-drying insulating varnish, which may be obtained wherever electric motor and transformer repair work is done. Dowels should be used instead of nails or screws for holding the parts together

For the base, the writer used a circular brend board. Its legs are three spools, by gate and dowels. A wooden disk, and in thick and large enough to fit

saughy within the cardcoard tube, is downled to the center of the upper surface of the base.

The primary coil may next be constructed, Cut enough strips of corrugated caedboard about 1/4 in. wide to make a length totaling about 9 ft. Soak these thoroughly in the varnish. Bend a neat loop in one end of the copper strip, large enough to pass the bolt that will botd one of the binding posts. Then, using a round can or box 71/2 in. In diameter as a form start winding the primary. Wind just 42/3 turns, with the varnished corrugated board as a separator. At the outer end of the strip, bend another loop for the bolt of a second binding post. After sliding the call from the form the turns may be bound rightly together by gix bands of adhesive tape. Half & dozen 3/16-in. dowels, set into the base in a circle of 71/2 in, outer diameter, will held the primary,

The secondary may be wound either by hand, on a lathe, or with a simple winding Continued on page 1151



From left to right; A 12,000-volt ages sign transformer, mice condensers, tuning coll, quenched spark gap, and the Tesla coll

HOW TO BUILD A SOLID SCALE MODEL OF A REMARKABLE NEW

French Pursuit
Plane

F STRIKING appearance the new lowwing French pursual plane the Hannot Biche, makes a model that is distinctly out of the ordinary. The scale of the model in relation to the full-sized plane is 4x in equals 1 fr

White pine is the most sintable would for the main parts, and bassa wood can be used for the pants "valve covers, and part D. If deared, the nacelle can be made of three pieces, the nose cowl and the propeller cone being carved separately. In the model shown in the photos, however, the nacelle was made in one piece, and no doubt this is the easier method. Small slots cut into the cone will

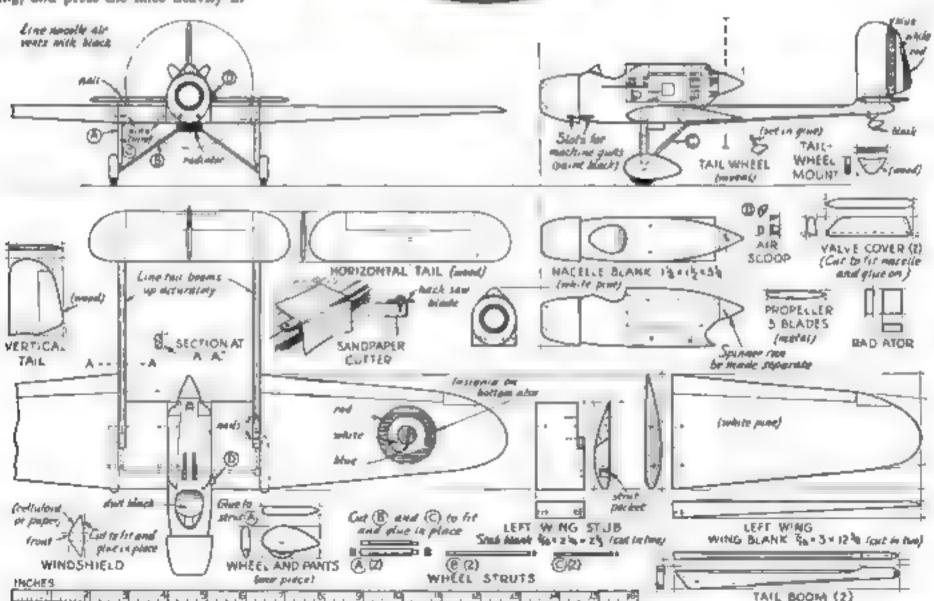
servento hold the propeder blades. Simply roughen the ends of the blades with a knife point and set them in glue. The nose cowl "dish pan" can be cut in with a sharp-pointed knife and smoothed with sandpaper wrapped around a small stick. Cut in the cockpit before rounding the nacelle.

Color are applied as follows nace le landing gear, tail booms, and tail-wheel mount, bright red; wings, horizontal tail, and vertical tail, yellow; tires and trim, black; nose "dish pan," gray. Outline the afterons, elevator, rudder, and nacelle markings with a bard pencil before painting, and press the lines beavily in

By DONALD W. GLARK



Only twenty-neven parts are needed to make this model. The larger units can be fastened with wire pipe and nails or, if preferred, with rement or glue alone. The original plane is a him-b aded pusher powered with a 600 HP, water-coned H appens for an engine A ring type radiator is not inside the mose cowing and enother which is rectangular, is attached directly below the nace is itself.



Working drawings with a scale for finding the dimensions of the various parts. The wing stubs may be made integral with the wings, if desired

BY BUILDING THIS Beautiful

A chair of this quality is very contly, but any amateur craftsmen can make one the it if he will take sufficient pains

wind their is as comfortable and enty a their as can be bought, but the price of a good one being beyond the reach of the writers purse, be finally decided to build one. In designing it, the best traditions of the chair maker's art as practiced during the eighteenth century, were followed.

The front legs are carved from a piece of solid mahogany 3 in. square and 16 1/2 in. long. Two blocks of mahogany, 2 1/2 by 3 in. and 3 1/2 in. long, are glued to each leg 2 1/2 in.

from the top to give sufficient stock for the flare. After the mortises have been cut and the brocks glued on, the legs are marked by means of a pottern cut from a piece of flemble cardboard. This is later used to make the stencil with which to lay out the carving on the leg (Fig. 4). The pattern is transferred to one side of the leg, which is then band-sawed. The adjacent side is marked for the next sawing. The leg is now shaped, but is still square in section (Fig. 5). It will have to be rounded with spokeshave chisels, and file. In curving the foot it is best to brock out the toes and leave them until after as much as possible of the hall has been formed. When the toes are being carved, keep each knuckle the same distance from the floor. The carving on the knee requires time and care, but is not difficult. Out me the leaves with a Vtool, then cut away the background, and finally model the leaves

No great difficulty should be experienced in constructing the rest of the frame, except perhaps, the arm supports. They are made from hard popular blocks. 3 by 5 by 11 in. First saw to the abape given in Fig. 3, then cut to the shape.

shown in Fig. 2. It may be necessary to fill out a place or two with an extra piece of wood to get the proper shape, as shown in the photograph of the frame

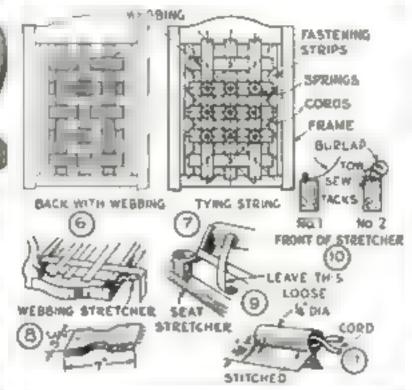
The finish on this chair consists of a coat of oil stain, a thin wash coat of shellac, and two coats of variish, rubbed down with pumice stone and oil.

To upholster the chair proceed as follows: Tack good hemp webbing to the bottom of the seat frame, to the outside of the back, and to the inside of the arms and wings. The webbing must be interwoven stretched and tacked with 12 or, tacks (Fig. 6). The webbing is first

For the back of the chair, nine 4-in pillow springs are sewed with twine to the webbing at the places where he strips intersect. Use an overhand stitch. Twe we heavier seat springs are sewed to the webbing in the seat. The the springs eight times with heavy twine (Fig. 7), using a weaver's knot. The twine must be stretched in such a manner that the springs may be compressed without tearing or loosening the twine where it is tacked. It must be taut enough, however, to bold the springs straight

When tied, the springs must be covered with beavy burlap, About three yards

will be needed. Pull it through the opening between the back legs and the vertical strips A, Fig. 2, and tack it with 6-oa. tacks to the back of these After the faling material has been put on the back, the muslin which covers it and also the uphoistering material are drawn brough this opening and tarken in a serial manner. At the borrow of the back, the materials are drawn through the opening between the seat rail and the stretcher above the seat rail and tacked to the back of the latter. They are drawn to the back, to be tacked at the top of the chair. The webbing on the arms and wings must also be cov-



Diagrams showing the general method of app y ng the webbing and making rolled edges and we'ts. The complete transports is illustrated as the right

tacked at one end, then steetched as shown in Fig. 8. and tacked before being cut Double the ends of the webling over the first few tacks and tack through the double thickness. The vertical webbing on the inside of the arms is tacked to the out side of the seat frame, uster the uphalstering on the inside of the arms is all in place. It is necessary to leave it unfastened at the bottom so that the burlap muslin, and upholstering material can be drawn down and tacked to the outside of the seat stretcher. When this has been done, the webbing may be pulled tight and tacked. By fastening the upholstering material, muslin, and webbing to the out side of the seat stretcher the top of the stretcher is left free to tack the burlap and muslin which cover the springs of the seat (Fig. 9)



Chippendale Wing Chair

By Franklin H. Gottshall

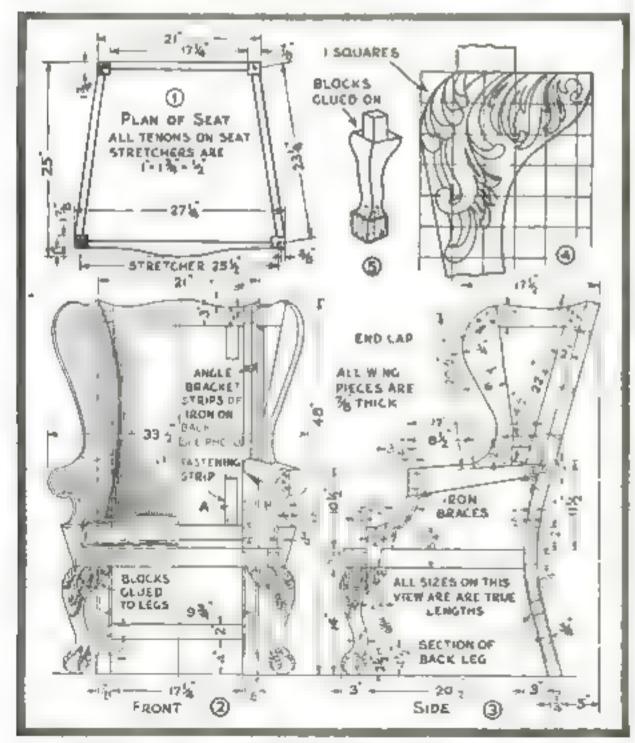
ered with burlap, to which the filling may be sewed

After the burlap has been tacked in place, the chair is laid on its back and a 5 or 6 in, thick filting of moss is evenly distributed over it. This thickness is considerably reduced when the musical is stretched over it. Long loops of twine are sewed all over the burlap. When the moss is worked into these loops, they prevent it from sliding about. The moss is first "picked" (pulled apart) to form a springy mass. Not all of the moss need be pulled through the loops—only enough to hold the upper surface of the layer to itself.

The insides of the wings and arms are padded in the same manner, though the filing will vary in thickness from about 1 in., or a little more, around the tops of the arms, to a greater thickness where it is needed. Great care should be taken to keep the filing springy and uniform. The muslin is now stretched over the filling

one surface at a time. The seat should be done last of all. A thin ice pack may be used to shift the moss after the muslin has been stretched, where this is necessary to get the surface smooth. This surface will be considerably improved if a thin tayer of cotton felt is placed over the moss before the muslin is stretched over it.

The seat, at the front, has a built-up roll edge, consisting of a roll of tow incased in burlap and tacked to the top of the seat stretcher (Fig. 10). This roll is made fairly hard by sewing a running statch along its entire length after it has been tacked in place. A piece of uphoistering material 7 in, wide must be sewed to the mushin at the front of the seat. This is tacked to the front seat stretcher, along the outside, and to the side stretchers, back as far as the rolls of the arm supports. The tacks holding it will be covered later by the strip of material shown at the lower edge of the seat in the photograph of the finished chair,



Front and side views, plan of sent, one of the foot blocks, and a pattern for the carving. Many parts, being at an anger, are roogs than they appear to be, so the true sangths have been marked



No chair can surpass a correctly damped, well-apholatered wing chair in comfort, and it is, at the same time, highly erasmental

The upholstering material—7½ yd, of 38-in, width—used to cover the chair shown was a hand-woven tapestry in an old Colonial coverlet design, known as the "big diamond," A plain material, purchased from a dealer, will serve the purpose, however

Cover the inside of the wings and arms first. Cut a pattern from heavy wrapping paper, and in cutting the cloth, take considerable care to match the material so that the figure will go in the right direction and be well balanced. Allow several extra lockes of cloth for stretching. The easiest way to cover the wings and arms is to sew a seam directly above the arm, joining the wing cloth to the arm cloth at that place. The writer used only a single paece of cloth for the wing and arm, but this is considerably more difficult to fit Slip-tack the material to the rear of the back leg, that is, the tacks are not completely driven, which allows them to be removed and the cloth restretched as the fitting progresses. Use 3-oz, tacks and always tack from the center to the ends. The inside wing cloth is drawn around and tacked to the outside of the wings.

The material covering the arms is tacked to the outside of the seat stretcher at the bottom, after which the webbing may be fastened as mentioned before. At the top it is tacked under the arm roll and sewed to the wing material with a curved upholsterer's needle, using a blind stitch. The cloth for the back (inside) is fastened next. It is tacked to the rear of the vertical states.

The welt consists of cording of some kind, covered with upholstering material (Fig. 11). A (Continued on page 103)

Dogwood Bouquet

formed from

TIN and WIRE

A PERMANENT bouquet of dogwood blossoms to decorate your home can easily be made by anyone handy with tin

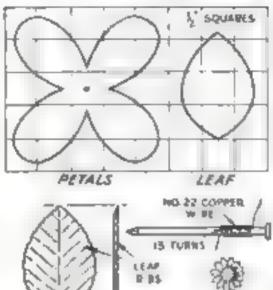
an.ps and soldering trop.

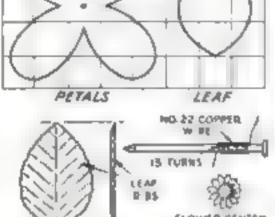
The materials required are a tin coffee can, some copper wire, white and given enamel or lacquer, and solder. First make patterns for the petals and leaf by marking out 1/2-in. squares on paper and using them as a guide to copy the design. For the bouquet illustrated, three sets of petals are needed, so they are cut from tin to match the pattern. A hole to take a No. 14 wire is punched in the center. The petals are then bent to shape with the fingers, enumeled white, and hung up

Thirteen tin leaves are required. They are rabbed to make them appear more real. This is accomplished with pliers having a straight side. First fold them from end to end, then from the center out as shown in one of the drawings.

Solder 4-in, lengths of No. 18 copper wire on the leaves for stems. Enamel the leaf, but leave the stem bare.

To make the center of a flower, take some No. 22 copper wire and wind it on an 8-penny hail to form a negt coil spring About thirteen turns are necessary for





Decorative arrangement of dogwood binstoms and leaves made entirely of metal. Because of their mudernistic questy armemants of this type are now enjoying a popular vogue

each flower. Bend this coiled wire so the ends meet, and book them together. Solder this doughnut-like coll to the end of a No. 14 copper wire about 10 in, in length Dip the coil in green enamel and let dry,

When the enamel on the various parts is dry you can start assembling. Slip the petal part of a flower on the stem and wind a few turns of fine wire in the back to hold it in place. Secure with a little

solder, being careful not to unsolder the flower center by using too much heat.

The flower stems are soldered together and then the leaves are soldered on. A good way to bandle the leaves is to solder three together, and solder the group to the main stem.

Now arrange the flowers and leaves into an attractive bouquet and point the STORIE -- BASYLE PALMER



COAT HANGER BRACKET

THIS attractive pg-sawed fixture will hold six wire coat hangers in a minimum of space, and it can be conveniently fastened in any nook. The shape of the hooklike projections was especially chosen to avoid the danger of sharp points. The bracket is cut from a piece of 12 in. hardwood and screwed to a 4a by 115 by 14 in, wood strip, which may, in turn be fastened to the wall at top and bottom. Seven feet from the floor is a statable heighth. Enamel or larguer the fixtures to match other woodwork.-E. A. B.

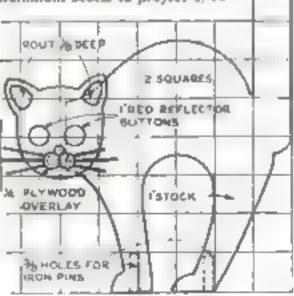
BLACK CAT DISPLAYS HOUSE NUMBER

ARCHING his back in welcome, this black cat is a striking novelty to set at the entrance of the driveway. His eyes, which are red reflecting buttons, g ow at night when the headlights of a car flash upon them.

The body, legs, and tail are cut from a 12-in, board with the grain running ver-

tically in the design, while the bead it a separate piece nailed to the neck. The bose overlay since it is thin, should be of

Saw all the parts, hore holes to receive the eyes (allowing the alummum besels to project 1/16



By drawing I-tu. squares on wrapping paper a full-size pattern can easily be prepared



A nove way of displaying a house number prominently at the entituce to a driveway

in) and gouge or tout the car openings to a depth of about 3% in, before nating the cut together. Also, gouge grooves in the back of the nose piece to receive the whiskers, which are 16-penny box rails. At the back, where the neck overlaps the head round the corner to a radius of

A twisted piece of a dry tree branch is a suitable base. Bore it and the cat's feet. to take Agent, round from pins for holding the whole upright Paint the body black and the whiskers red, and align the aluminum figures to conform to the arch of the back.-Enwist M. Love.



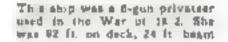
Privateer Model

AVE you started our new ship model, the Swame, a privateer of the War of 1812? She was one of those Baltimore topsail schooners so femous, the world over, for their speed and the daring of their crews—picturesque to the last degree.

she makes a remarkably good-looking model because of the fine hull lines and slender spars and rigging. Another advantage is that the model, although small, is built to the scale of 1/2 in, equals 1 ft, which is an easy scale to work to

In the last issue (PS M., Nov. '34, p. 65), we described the making and

By Capt. E. Armitage McCann

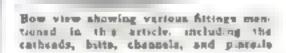


slightly thicker on the inside and with notches to take the deadeye straps. Their shape and positions were shown last manth in one of the photographs and the deck plan on page 67.

As the pinrails are placed in the same positions, only inside the bulwarks, make them also. They are thinner, as shown in the deck plan and profile drawing of the deck

fittings, and have to be notched to take the timber heads. Glue all these in position, then nail right through from the outside with "240, pins. There are also pintails forward and aft. The belaying pins can be bought ready-made or turned from brass rod, although for a simple model beadless pins, painted brown, can be used. Drill boles to make them a tight fit. If brass is used, atam it brown, I used 1/4-111, pins, which are a bit over scale but as small as is practical in fact 5 16-111, pins would no. Note that belaying pins are indicated by solid round dots on the deck plan, and all the eye- or ringbults by small circles drawn in outline.

The channels (antonial on page 98)



pointing of the hull. Those who did not see that assue should look at up

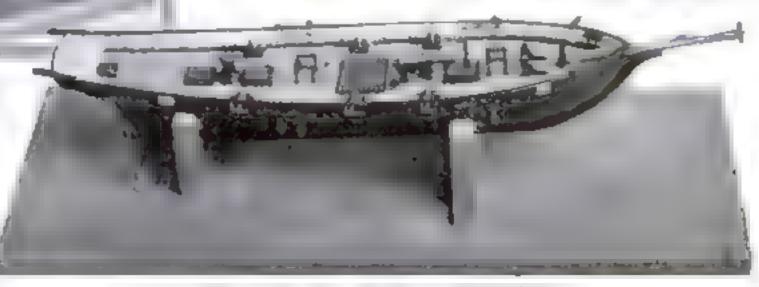
and get to work.

There are a few parts of the bull proper that could not be described in that issue for lack of space. It would be more logical to apply them before the painting, but if the painting has been done, just scrape a space to glue on these other parts.

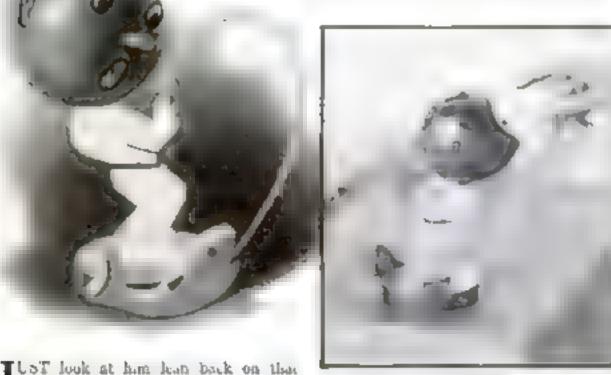
The channels to spread the rig-

Four of the banches, the capetes, the banchese, the bost daylts and boat, and several guns can be such in this view, which shows the madel from the stern

Hall with principal fittings in position. The hall irrell in 13 in long but the overall dimensions of the finished model are 20 in long, 13% in, high



Comical Fisherman Catches Ashes



A recover is used for the faherman's head, and, being hollow, serves as an ask contained

wotta fish, wotta man! And what an ash tray!

Get a coconut, wire-brush it smooth

Get a coconut, wire-brush it smooth mark off the holes—a large hole for the cigarette ashes, two \$\frac{1}{2}\sin\$, holes for the dowel that supports the head, and a \$\frac{1}{2}\sin\$, hole for the fisherman s nose. Make the holes with a small drill and ream them to the proper size, Cut out the large opening by sawing off a thin slice of the shell and clean out the mest in the coconst

Make the wooden parts as shown. The fishing reel is a small disk of wood \$\frac{1}{2}\$ in in diameter and \$\frac{1}{2}\$ in, thick with a \$\frac{1}{2}\$ in hole bored through the edge for the lishing rod. The reel bandle is a \$\frac{1}{2}\$-in parts of toothpick stuck is a pinhole made in the side of the reel. The rod is a

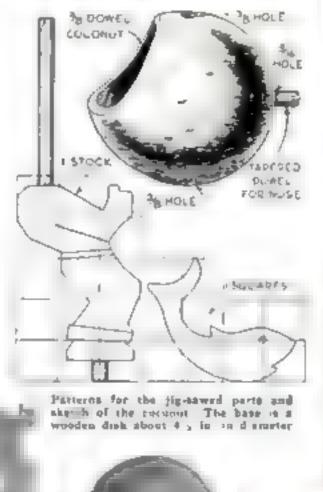
Main, piece of ration or wire.

Sandpaper and assemble the parts. Fasten the fish to the flat edge of the base with a wire not Paint the fisherman's head and hands a hulf color, thecks rosy ups red, and ears, eyes, and harr black. His shirt, trousers, and

shors are white trimmed with back. The fish is green trimmed with black, and the base is black.

The fish can be attached more securely to the base is flattened slightly at that point.

—CHARLES HALDER

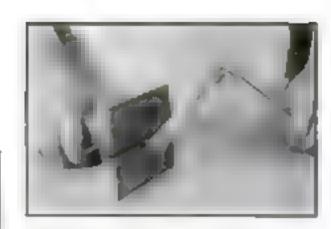


The ash-tray parts ready to be assembled. The long upper dowel extends right through the cocount to hold it steady

SQUEEGEE OF SPONGE RUBBER

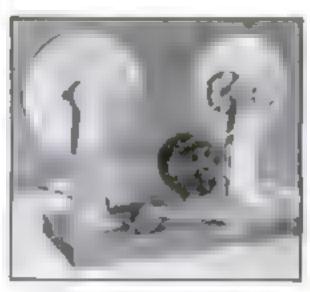
For ferrotyping photographic prints, many prefer a squeeges to a roller. The squeeges shown was made from a strip of sponge rubber, 3 by 8 in., cut from the edge of a kneeling pad and clamped between two pieces of plywood 2½ by 8 m. Kneeling pads are made of a rather dense sponge rubber, which is ideal for this pur-

pose. The vulcanized edge of the strip should project about 1 in, as shown. Wood screws hold the rubber firmly between the strips. The handle is finished off by filling in the top edge with a square strip of wood.—Daniel Reynolds.



HEAT SHIELD ON PLIERS PREVENTS BURNS

WHEN using a torch to heat up small pieces held in phers, I use a shield to keep the flame away from my hand and to prevent the end of the pliers from becoming hot enough to draw the temper. This shield is just a square piece of sheet metal bent over double in the middle as shown so that the puers grip both the shield and the work.—A. Moore.



MOTOR RESTS ON HINGE

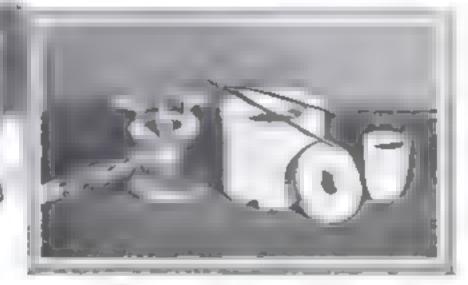
A statple, neat base for a small motor may be built from an ordinary T-hinge in the case illustrated, a 4-m, hinge was used, the motor being mounted on the long leaf and the short one acrewed to the baseboard. Two 1/2-m, brass tubing uprights were used to raise the motor to the right height, and 6-12 machine acrews were run through them in a tile motor casing. The end hole in the hinge was enlarged to accommodate the switch, which is of the toggle type used in radio sets, and a spring was added to give the tension necessary for keeping the belt tight.—Patt H Neuson



Ferrotyping a photographic print with a squeages made by clamping sponge robber between two strips of wood

Homemade Furnace Melts Aluminum

WITH ORDINARY ILLUMINATING GAS



The burner asbeston baffle crassble and cover are shown at the eft The body o the hurner is an old 2 by the gas and air enter through the side putlet

Donald R. Doremus

URNACES for melting brass are often constructed by amateur mechanics with a vacuum-cleaner blower for the forced draft. I have such a furnace, but I use a paint-spray blower for the forced draft and get very good results. However, I have found that aluminum can be melted without a forced draft, and as aluminum will answer the purpose in most cases where castings are required by the amateur mechanic, I think my method will appeal to many who have hesitated to attempt making their own castings. The average amateur with a small lathe will find working with aluminum every bit as easy as brass.

Brass requires 1.800 deg. F. to melt, while pluminum only requires 1,200 der. The burner shown in the photographs melts

aluminum with ordsnery illumina.inggas It was made from an old 2 by 11/4 by 11/4 BASE in pape tee. A pape ping was screwed securely into the bottom and machined off. Then a shoulder was cut on the outside of that end of the tee and fitted into an opening in an ord lamp base, which had been machined to match. The edge was peened over to hold it in place.

Reducing bushings were used in the side outlet to reduce it to 34 in., and a piece of 34-in. brasi pipe about 3 in. long was /Contmued on page 97)



Castings for models and for such affractive nove that as this samp are made with the aid of the furnexe

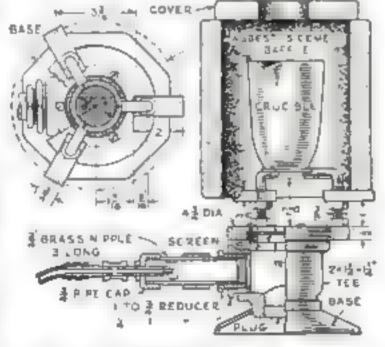


The amp ready for assembly. This project is a good

example of what can be done with homemade captings

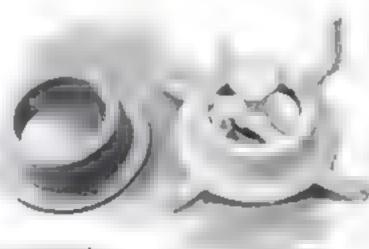
The mixture of gas and air is adjusted by

mana of a sliding shows on the inlet pipe

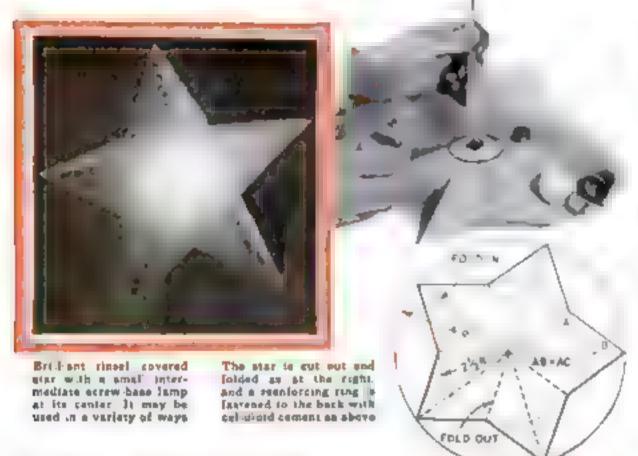


HOW MELTING FURNACE IS CONSTRUCTED

Working drawings of the furnace. Aluminum melted in it is case a said which plenty of vinces must be smale, as shown by the rough casting at the right



New Ways to Light Your



IGHT, as produced by the electric amp, Affords perhaps the most arriking and benduful means of telling the world that you are in tune with the Christmas holiday season. To arrange on attractive decorative scheme with light in neither costly nor troublesome. George R. LaWall, a Cleveland il luminating engineer, has designed a number of new lighted novelises that can be built by anyone from cardboard and somilar inexpensive materials. They employ lamps so small that the current consumed is negligible

Most of these nove lies are built around the S-11 Masda lamp, obtainable in 6and 10-watt sizes. This lamp has an intermediate screw base and a bulb diameter of 11/6 in. The lamp is held in an intermediate screw socket of the pigtail type, with bakelite shell. Both lamp and socket can be obtained through electrical dealers, or from stores banding lighting equip-

The "tinsel tree." one of the most striking decorations designed by Mr LaWall, becomes a mass of glittering jewels when alight. The effect is the same front and back, so that it can be placed in a window or in front of a mirror indoors.

The base, which can be used also for other decorations of similar design, consists of two disks or squares arranged in pyramid fashion and surmounted by a cy-Ludrical piliar that forms the stem of the tree. The tree part consists of a hollow isosceles triangle built up of cardboard segments, which are themselves triangular in cross section. The pieces are arranged to taper from the otter edges towards the center, so that light from the bulb in the center will fall on their surfaces. Small triangles of cardboard or cardboard frames covered with translucent colored paper serve as shields to cut off direct light from the lamp. The dimensions of the various parts are indicated on the accompanying sketches. You can use any type of glue to

fasten the cardboard pieces together, but celluloid cement, such as builders of model airplanes employ, is particularly descrable because it dries rapidly

It is a bit of a trick to produce the triangle. When the three segments are laid out, cut part way through the cardboard with a sharp knife, along the lines where the material is to be folded. Fold with the scored side out, Before assembling the pieces permanently, test the bottom or lower segment to see that the lamp socket fits snugly in the openings cut for it.

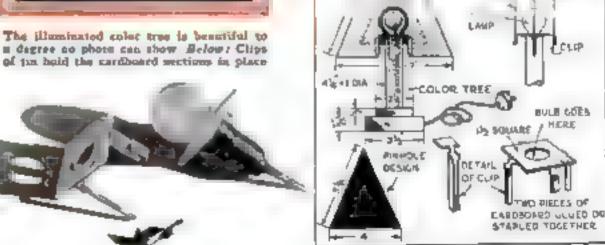
The application of color and tinsel is done best before the base is fastened to the triangle. The base can be finished in a variety of ways and with water or oil colors, brushing lacquer, quick-drying enamel, or with colored paper glued on.

From a dealer in show-card artists' supplies you can purchase various kinds of tansels or "fluter." These are metallic flake materials that reflect light. They are obtainable in various colors. For most purposes of Christmas decoration, the sivery timed, which is generally the least costly (about 35 cents for 54 lb.) is setinfactory. The fine grade is preferable Paint the front and back aloping surfaces



ROY ELTON

a degree no photo can show Below? Clips of 122 hold the cardboard sections in place



The areal treate or are alipped into their

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Home for Thristmas

Assembling the

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of the triangle with thin give, such as white casein glue mixed with plenty of water, and aprinkle the tinsel liberally over the glue. When the adhesive has dried, remove excess tinsel by gently tapping the triangle edges with the fingers. These edges, incidentally, can be colored m any manner desired, as they do not reflect light from the bulb

The "color tree" is simply a variation. Color one side of the central triangle red and the other green. The outer surface of one of the smaller triangles can be grange and that of the other silver. Tinsel of different colors is effective on the center triangle. In the smaller triangles, opposite the bulb, make a pinhole design—a star, reindeer, or other suitable form traced by punching holes through the cardboard with

The tinsel star is another decorative lighting novelty described by Mr LaWall. It is particularly suitable for producing



This mestarpiece of lighting is a beautiful combination of effects anyone can duplicate

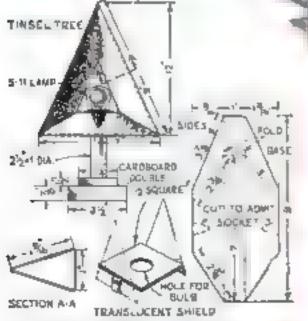
high ights in festoon decorations, and for window decoration. The star is made of heavy paper or thin cardboard, folded so that it is hollow on one side, and provided with a central hole that receives the base of an S-11 lamp. The hollow side of the star is covered with tinsel.

Even larger bulbs, such as the standard 25- or 40-watt size, can be employed to produce striking effects. For example, an interesting fixture for outside use can be made by mounting a socket in the center of a reflector baving a matte surface, and equipping the hulb with a shield that is perforated with suitable designs. The reflector can be a 10-in, aluminum mixing bowl, the surface of which is given a matte finish by the application of a strong lye solution. A screw-ring porcelain socket is mounted in a hore in the center. The builb is equipped with a shield cut from then sheet metal (or even a cardboard medicine box of suitable size if the lamp is a small one). Tiny Christman trees, flower petals, or other designs are cut in the shield and covered with one of the colored filter materials sold for use with store window lighting fixtures. The part of the shield covering the tip of the bulb and not enterms into the reflected design can be fitted with a filter of a contrasting or harmonizing color

A variation of this principle can be applied to wall surfaces, such as the outside of a bunding. Mount a socket in the center of the area, insert a 60- or 100-watt bulb, and place around it a shield of fireproof material suitably perforated and equipped with heatproof color material, A satisfactory shield can be made from an empty coffee can and lid. Mount the socket on the inside of the lid and punch the design in the (Continued on page 111)



board and is righted by a small lamp



How the greament is made. Note that each leg of the triangle is itself triangular in cross section. Right! Sprinkling the tinsel

Unique Perpetual Calendar

P. G. LACKEY

NO CHANGE the date on this novel perpetual calendar, the pivoted box part merely flipped over each morning so as to bring the rear aurface towards the front. The new number then appears automatically in the window. This always interests and pusales onkokers, aithough the mechanism is really quite simple—a series of seventeen blocks that slide up and down in a predetermined or-

Make the box first, preferably from a good cabinet wood. The windows may be left open or fitted with small glasses. If glass is used, be sure that the inside is flush or sunk a trule, Assemble and glue the four sides with the windows at opposite ends. Leave the ends open.

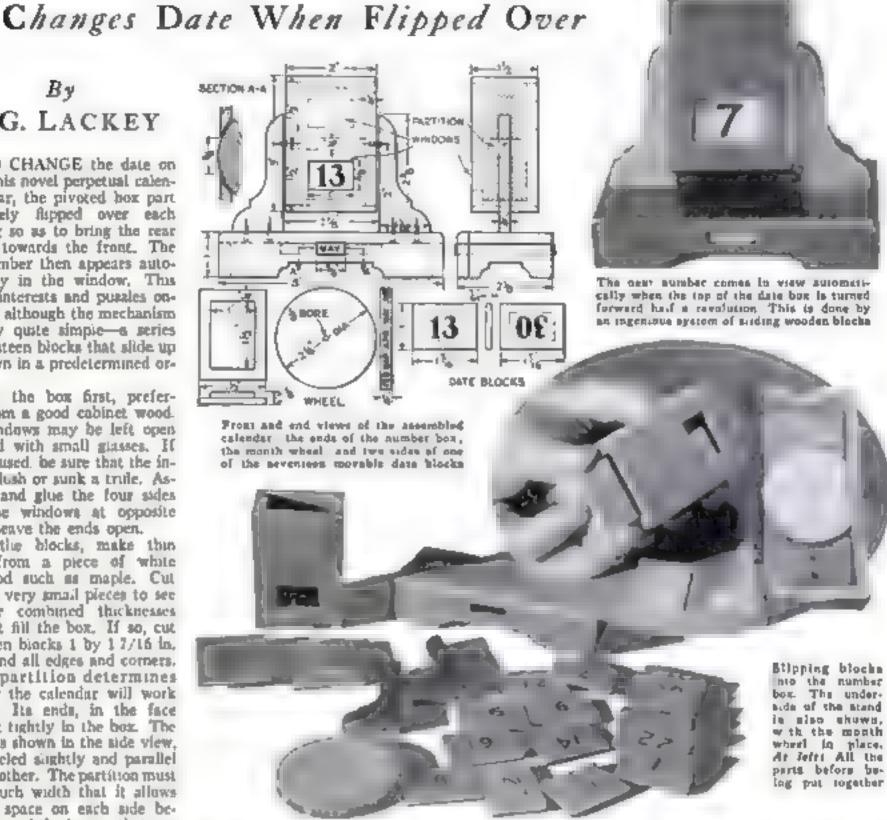
For the blocks, make thin strips from a piece of white hardwood such as maple. Cut off nine very small pleces to see if their combined thicknesses will just fill the box. If so, cut seventeen blocks 1 by 17/16 in. and round all edges and corners.

The partition determines whether the calendar will work or not. Its ends, in the face view, fit tightly in the box. The edges, as shown in the side view, are beveled sightly and parallel to each other. The partition must be of such width that it allows enough space on each side between it and the box so that one

block will pass through on each side at the same time. Glue or nail the piece in place, making sure it is accurately centered.

Try the number blocks to see if they slide correctly. Put eight pieces in one end of the box and nine in the other, as shown in the side view. Hold the ends of the box on and turn the box top toward you a half revolution. Do this about thirty times. If a block drops from the top in front of the window each time it turns over, you will know everything fits correctly. If the windows have been left open, draw a square the size of the window on each block as it drops down, and number these from 1 through 31. After 31 there wil, be three blank blocks. These may be left blank, pictures may be put on, or you may print the words "Tues Slowly" on them. The next number should be 1. If so, everything is correct. Remove the blocks from the box and paint on the numbers.

If the windows are covered with glass, you must number the blocks in the following order, a number on each side of



the block. Invert the number on the backs, as shown.

118	\$1 40	25-5
3 - 20	15- 21 ank	2" 10
5-22	1" Brank	29-17
7 24	19-2	31 14
9-30	21 4	Blank-16
11-28	216	

Now you are ready to place the blocks permanently in the box. Arrange them in the following order with number I on top. 1, blank (with 16 on the back), 31, 29, 27, 25, 23, 21, 19. This group goes in the bottom compartment with number 1 showing correctly in the window. Now put the lower end on temporarily. The order of the other group is as follows from the top down blank (with 17 on the back), blank (with 15 on the back), 30, 28, 26, 24, 22, 20. Set these in the other end with the first brank showing in the window. Place the upper end on the compartment temporart.y

Now revolve the box, top end toward you. If the numbers appear at the windows correctly, the ends may be glood

permanently. Be careful not to get any excess glue inside of the box, otherwise the blocks may stick,

The stand is made as illustrated. Cut an opening 14 by 16 in. or longer in the front of the base for the names of the months to show through. Prepare a disk 21/4 in. in diameter from a piece of maple or other white hardwood 1/4 in, in thickness, divide the edge into 12 sections, and paint on the names of the months. Fasten this in place with a small screw through the center of the disk

The payots for the box are made from 1/2-in, screws with the heads ground to the same diameter as the shank. These are screwed into the upright supports 2 m. from the base and with 5 16 in. of the screw left showing. The box is now balanced and the pivot points marked. Bore small holes the size of the screw. Fasten one upright to the base, fit the box between the pivots, and fasten the other up-

The calendar may be finished in any way you wish



HAVE YOU TRIED THIS ENJOYABLE WAY OF HEIGHTENING ENERGY?

MRS. CHARLES DALY, bousewife, says. "Camels pick up my energy ... and have a mild, delicate dayor that a woman like."



REX MADI, famous sportsman, says: "When I've gotten a big game fish landed 1 light a Camel, and feel as good as new."

As this magazine goes to press, reports pour in from all parts of the country...showing that thousands of smokers are turning to Camels...and that they do "get a lift with a Camel."

Here's a typical experience. Mr. Crawford Burton, the famous American steeplechase rider, is speaking:

"Whether I'm tired from riding a hard race or from the pressure and tension of a crowded business day, I feel refreshed and restored just as soon as I get a chance to smoke a Camel. So I'm a pretty in-

cessant smoker, not only because Camels give me a 'life' in energy, but because they taste so good! And never yet have Camels upset my nerves."

You have heard the experience of others. Science tells us that Camel's "energizing effect" has been fully confirmed,

So try Camels yourself. You can smoke as many as you like. For Camels are made from finer, MORE EXPENSIVE TOBACCOS. They never taste flat...never get on your nerves.

o your GARGEL

ALL TOBACCO

from finer, MORE EXPENSIVE TOBAC-COS — Turkub and Domestic — than any other popular brand."

Camel's costlier Tobaccos never get on your Nerves

Remember last winter

This year, play safe with

EVEREADY PRESTONE

From the standpoint of evaporation there are only two kines of anti-freeze — those that bod away ('treated' or not' treated') and those that do not bed away There is no middle ground Evereally Prestone does not bod away Don't confuse Evereally Prestone with any anti-freeze rontoning alcohol or giveering

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NATIONAL CARBON COMPANY, INC.
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FIND YOUR CAR ON THIS CHART

IMPORIANT The price per gallon of an anti-freeze means nothing unless you know how many gallons you will need during the winter. You can't get that information on a buildway anti-freeze—you don't know how many gallons you will need. But you can get it for Exercisedy Prestone—and here it is See how reasonably you can get two-way protection off winter long against both freeze-up and gust with one shot of Everendy Prestone—one shot because it won't boil off, no matter how warm the weather gets between the cold enaps.

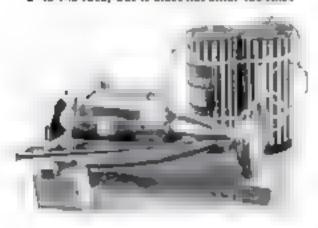
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New Trophies from Old

Asphalt varmed to applied with a roller to the Jace, but it must not enter the lines



2 Temperary playing tank attached to the cup. The gnode is a curved supper plate



3 A chase up of a heat tank and a control and a control at the policy policy policy policy and a control policy an

4 At laterwale the are e as red to shake a property



Ingenious method of electroplating fills up all unwanted engraving so that discarded silver cups and similar prizes may be used over again

THOUSANDS of trophies and prize cups that are now gathering dust in schools,

gathering dust in schools, clubs, and on freplace mantels can be made like new again by a simple electroplating method

Clean the cup with facquer thinner, cement don't solder—any loose parts, and scrub the engraved lines with a ten percent solution of caustic potash, followed by a mose and a quick brushing with a ten percent sulphuric acid solution. Cost the face of the cup with a thin film of asphalt variash applied with an ink roller. See

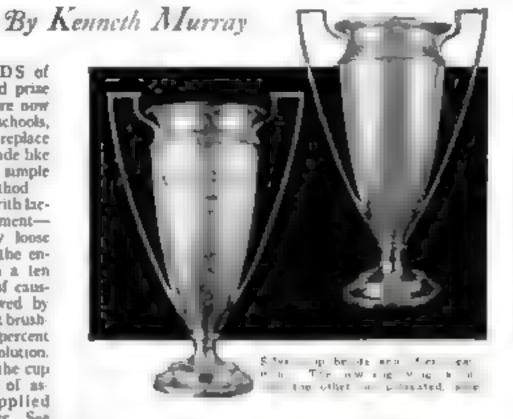
that none of the varnish enters the engraved lines, which are to be filled.

Four microscope slides and some putty can be formed into four walls that will hold the plating solution. Test it for leaks with water. Curve a sheet of clean copper to match the curve of the cup and suspend it, as shown, in the tank with a connection to the positive pole of the battery. Fasten a wire from the negative pole of the battery to the bottom of the cup. Two dry cells can be used for power, or you can use two cells of a storage battery with a small rheostal

Any standard copper plating solution can be used, but a saturated solution of copper sulphate is easiest to prepare and safe to use. Pour enough into the tank to cover the anode. When close inspection shows the lines to be completely filled, which will take some time break the connection and remove the solution and tank. Clean off the varnish and putty marks with gasoline.



5 The resilvering solution which is poisonous but not especially dangerous, is applied by means of a cloth wrapped around a small state.



Hy wrapping the end of a copper wire with cotton soaked in the plating solution and making the usual connections, you can retouch or blend the work in spots. Dry the surface and give it a light huffing with a polishing compound,

Resilvering of the cup may be accomplished by plating or with a silver compound that is merely subbed on. The latter may be made as follows: In 1 oz, of distilled water dissolve, one at a time, silver nitrate, 25 grains; sodium hyposulphite (hypo), 40 grains; sal ammonue, 25 grains. Give the face of the cup as

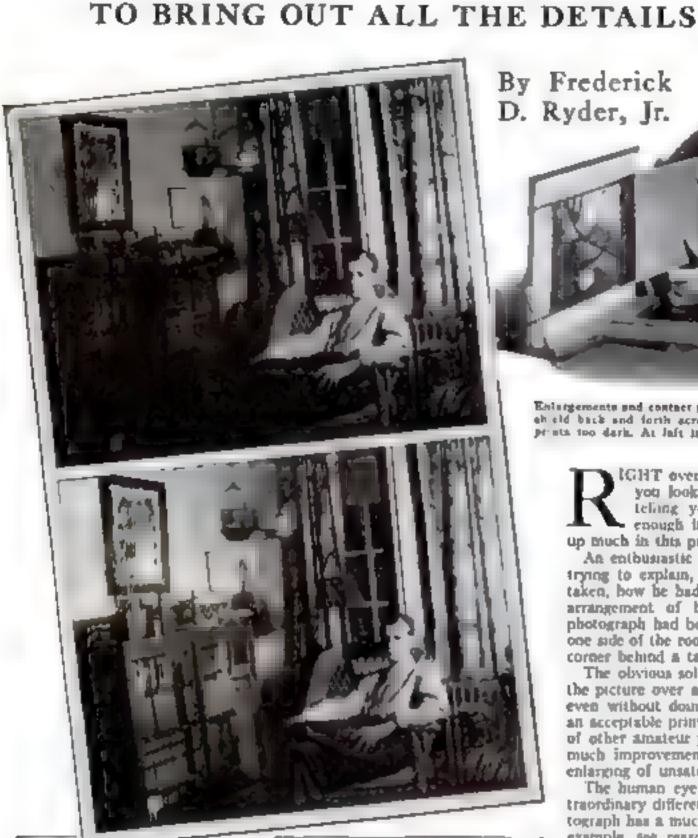
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will take, rinse and



6 The first building and policifing with jewsler's coupe must be done very lightly and continuity

How to Shade Your Photos



*50 in New Photo Contest

HERE is another chance to wip a prize for your skill in photography Just send in one or more of the best pictures you have taken recently. It doesn't matter what size the prints are or what the subject matter happens to be. The prizes will be as follows:

SECOND PRIZE 15 FIVE PRIZES, SI cach 5

Mail your entry to the Photographic Department Port LAR SCIENCE MONTHLY, 381 Fourth Avenue New York not later than January 2, 1935, and mark at "December Photo Contest." It is not necessary to send the films.

Write on the back of such prist your name and address and what type of lighting was used—daylight, photofiesh bulbs, photofood lamps, or other artificial illumination. No priots will be returned unless a self-addressed, stumped anyelope is inclosed. The contest is open to any amateur photographer except employees of POPULAR SCIENCE MONTHLY and their families. The developing and printing, of course, may be done by a professional. In case of ties, each tying contestant will be awarded the prize tied for.



IGHT over here—you can just make it out if you look close—is that new jig saw I was telling you about. You can see it clearly enough in the negative, but it doesn't show up much in this print.

An enthusiastic home workshop friend of mine was trying to explain, with the sid of a photograph he ditaken, how he had worked out a new and convenient arrangement of his machinery. Unfortunately, the photograph had been made by the light coming from one side of the room, and the jig saw, away off in one corner behind a tail cabinet, had been poorly lighted.

The obvious solution in this case would be to take the picture over again, using an additional light, but even without doing that, he could easily have made an acceptable print from the negative. Like thousands of other amateur photographers, he had no idea how much improvement can be made in the printing or enlarging of unsatisfactory negatives

The human eye automatically compensates for extraordinary differences in illumination, whereas a photograph has a much more limited range. You can for example, see reasonably clearly and in detail an ouject in a dark corner of the room and at the same time see the texture of the drapery hanging in the window where it is bathed in the direct rays of the sun. In a normal photograph of such a subject, if you make a print light enough to show the details of the object in the dark corner, then the whole area pround the window will be just so much blank white paper with no details at all. If, on the other hand, you make a print dark enough to bring out the window details then the darker portions of the room will be represented by coal black areas in the print. The same effect is noticed in all sorts of outdoor pictures, wherever there is strong and uneven lighting

In previous articles, I have discussed intensification of the negative and choice of different kinds of paper to bring out the picture to best advantage. (See P. S. M., Sept. '31, p. 83, Oct. '31, p. 78, and May '33, p. 76.) But changing the degree of contrast one way or the other all over the negative helps only a little when the difficulty lies in uneven lighting. What is required is to make a print or an enlargement in such a way that the nections which normally appear too black are held back, and the sections that appear too light are printed to a darker shade. (Continued on page 80)



... with Eastman's new high-speed "SS" Film

THINK how much more thrilling picture making becomes? Now you can take snapshots indoors—at night! All the "home life" scenes you could never get are at your finger tipe—without special skill or elaborate equipment.

Use a camera with an f.6.3 (or factor) lens, loaded with Kodak Super Sensitive Panchromatic Film.

This high-speed (extra sensitive) "SS" Film does the trick—it's three times as fast as ordinary film under artificial light.

For light, use two or three Mazda Photoflood bulbs. Just hold the camera in your hands us you would outdoors, set for 1 25 second, lens at f.6.3 opening, and click the shutter.

For indoor pictures at night with slower lens cameras (including box models) use Verichrome (or "SS") and a Photoflash hulb—sea free folder—with camera set for "time" exposures.

FREE POLDER . complete instructions on indomnight photography. Floringfood suspicion — Photofood pictures — pil que coursed in this (see falder. At vote Kodak degler's -or write for your copy today. Kastman Kudak Campany. Buchester. New York.



KOUAFLECTOR—Inexpendite, efficient . . . makes 2 Photofood builts do the work of 2. Complete, with stand, reflectors and cord, \$5. KODAK "88" — the lightning-fact film, with the green lightning flashes on the familiar yriow bot the film that indoors or out, in any light, improves pictura quality

RODAK \$1x-20 with Kndak Anastigment lane f.6.3 is ideal for night enapolete. Pictures 21x 3 % inches, price \$17.50. Kndak \$1x-16, with f.6.3 lens, please on 3% a 4% inches, \$20.

IP IT ISN'T AN EASTMAN, IT ISN'T A KODAK Ingenious Ideas

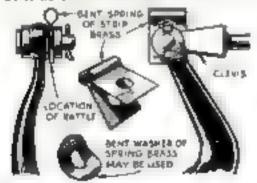
FOR CAR OWNERS

Our Readers Furnish New Suggestions For Handy Repairs and Improvements

RDINARILY, the job of equalizing brakes presents a difficult problem to the amateur mechanic and his meager supply of tools. However, by assembling the novel brake tester, shown in the illustration at upper right, anyone can obtain on accurate adjustment quickly and easily. The tester consists simply of a 1by 3-in, board four feet long supplied at one end with two cupped blocks speced and shaped to fit a tire and at the other with a series of notches or V-cuts. To this, a pail and some sand or stones are added to compiete the equipment. To equalize a set of brakes, first wedge a broom handle or other piece of wood between the front sest and the brake pedal in such a way that the brakes are applied just enough to allow the loosest brake to slip slightly when an attempt is made to turn the wheel. Then jack up that wheel, tighten the brake adjusting bolt as much as possible, and slip the brake adjuster in place over the tire. Finally, hang the weighted pail in one of the notches and loosen the brake adjustment until the weighted lever barely turns the wheel. To bring the remaining brakes to the same adjustment, simply repeat the process with each wheel with the pail hung in the right notch If you wish the rear brakes to grip before the front units, simply adjust the rear wheels with the weight in the end notch and set the front brakes with the weight hung in the second V-cut,--- S. A. F.

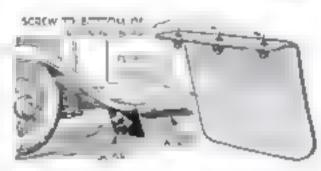
Silencing Brake Rods With a Spring Clip

ALTHOL GH various types of clips and springs are used to silence brake rod clevis joints, most of them are designed to stop only one kind of rattle. A better and more universal clevis-joint silencer is the homemade spring clip shown in the illustration. Made from spring brass or a wide corset steel, it is placed between the outer washer and the brake link at the joint. Serving to spread the ports, it holds the assembly tight, yet does not interfere with the brake adjustment. A spring washer bent as shown also can be used.—D



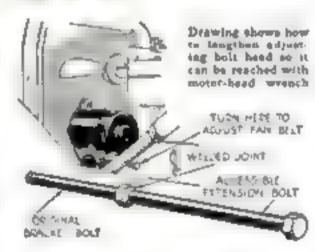
Homemade clip that silences brake rad joint

The apparatos illustrated at right, consisting of a notched rod and weighted pail, is used to gage brakes and equaltre their pressure on wheels



Rubber on Running Board Protects Radio Antenna

BY MOUNTING a square of rubber under the front edge of the running board, you can protect a running-board type of radio antenna from injury. It also will serve as a shield to prevent mud from being splashed up where it might cont the antenna and cause a possible short-circuit to the car body. Any piece of plable sheet rubber can be used; rubber stair podsform an exceptionally good source of materia.—D W P



Handy Bolt Extension Speeds Adjustment Work

OX CARS where fan-belt tenanon is adjusted by moving the generator, it is
often difficult to find a wrench that will
both fit and reach the partly hidden bolt
on the generator bracket. To get around
this on my car, I had a one- and one-halfmch length of cylinder-head bolt welded
to the top of the adjusting bolt head. This
provides just the right amount of extension and makes it possible for me to use
my cylinder-head wrench when making
adjustments. Incidentally, this same link
can be applied to screws, bolts, and adjustments located in out-of-the-way places
on any piece of machinery.—E. T. G., Jr.

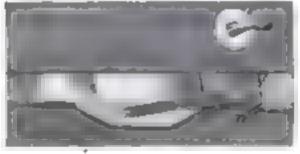
Stopping Hood Rattles With Old Fan Belt

WHEN the rubber pads under hood fasteners wear the hood rattles. A repair can be made with a section of old fan belt Remove the worn rubber and insert a suitable length of old fan belt.—H. V. T.



How to Repair Metal Arm That Supports Window

IF YOU own a closed car and an opened window anddenly fails to several when window suddenly fails to respond when the crank is turned, it may be that the metal arm supporting the glass has rusted through. How the writer repaired this arm on his car is shown in the illustrations. First, a new supporting arm for the glass was fashioned from a piece of three-quarter-inch maple. Along the top edge, a onequarter-inch groove was cut to take the bottom of the glass. Then the original stud at the end of the steel raising arm was punched out and a one-quarter-inch stove bolt substituted as a mounting for the new support, an iron washer being used on each aide of the wood block and the end of the bolt being peened over to serve as a rivet. To make the glass slide easily, the groove in the support was coated with graphite.—H. P S.





An easy way of repairing metal arm that supports a closed car window is shown shove

Socony-Vacuum Announces REVOLUTIONARY DISCOVERY IN OIL REFINING!

... that will save Millions of Dollars for Motorists this Winter

How the Socony-Vacuum Clearosol Process purges oil of impurities...why the new Mobiloil Arctic starts up to 50% easier... Lasts as much as 25% longer... Gives your Engine Complete Protection in Zero Weather

THIS WEEK Mobiloil dealers are acil ing a new kind of Mobiloil, made in an entirely different way called the Clearosol Process.

By actual test, this oil makes starting as much as 50° , caster, lasts up to 25% longer, coas gorn and sludge.

It flows quickly at low temperatures, and holes its body under extreme ranges of heat.

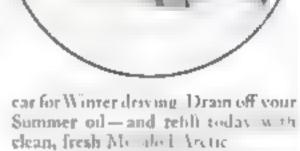
You may well ask, "How does all this happen?" The answer lies in a rew approach to oil refining

In the past, refiners tried to remove natural importace from a 1-by acid taths and bliver Society-Vacuum found a very to the characters clearings

Our new process actually district impanties—much as soap and water d solve dirt! The oil that results is practically 100% pure lubricant. Such an oil is naturally worth more to you, but we haven't increased the price per quart by a single cent.

Now is the time to prepare your

Ministure refiners where his my Vacuum waked on the Claimed Praces.



Just go to the marest dealer who shows the Mobilosl sign with the red Gargovle — or the familiar sign of the Flying Red Horse. Don't put off protecting your car. Act today! Socony-Vacuum Oil Company, Inc.

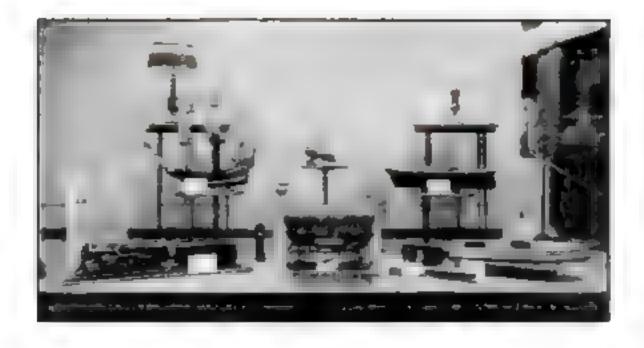
These bugs tapla bold the materials

These buge tanks hold the materials that wash unclean, non-inbricating aludge and gum from crude netroloum.

Mobiloil Arctic

MADE BY THE NEW SOCONY-VACUUM CLEAROSOL PROCESS





Home Workshop Clubs Plan Many Local Exhibitions



Starting eliver medal given by this magazine to a number of Guild slubs

ANY clabs affiliated with the Naountal Homeworkshop Guild already have their plans in thape for holding a local exhibition before the end of the year, Practically all of the remaining clubs, it is expected, will put on a craftwork show of some type before next March, in order that their best exhibits may be released in time for the National Exhibition and Contest, which will be held late in March.

Port tak Schnek Monthly is sending a beautiful sterling silver medal with the Guid meignis to each club of more than twenty members as a special craftwork prize to be awarded at its local exhibition. These medals are donated without cost to the clubs and are to be given for the best individual piece of work shown at each exhibition under the clubs own rules and regulations

The first application for a medal came from the rapidly growing and energetic Wood-Ridge Homeworkshop Club of Wood-Ridge N J., of which L. J. Messenger is president and George N Schalk, secretary. Its application was rapidly followed by those of the Lexington Homeworkshop Guild of Buffalo. N.Y., the Homeworkshop Guild of Richmond, Va., the Topeka Homeworkshop Club of Topeka, Kans., the Fairfield Hobby Club of Fairfield, Ala., the Madison Homeworkshop Club of Madison, Wisc., the

Popular Science silver medals distributed as special prizes for craftwork . . . Activities of the Guild expand rapidly

Edgene Craftsman Guild of Eugene, Ore., the Rockford Homecraft Club of Rockford, Iii., the Scraston Craftsman Society of Scranton, Pa., and others

Two clubs have already held their exhibitions—the Topeka Chib, which now has sixtytwo members, in September, and the Eugene Craftsman Guild in October The Bhon Guild, Fairfield Club, and Scranton Society are scheduled to hold their shows in November

The Topeka Club, with the great enthusiasm and cooperative effort it has displayed ever since it was organized, staged its exhibition before the Popular Science medals were ready, but fortunately the die had been made so that it was possible to strike off one medal and right it off to (Continued on page 45)

ADVISORY COUNCIL

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WHITE or red lead should be used on done! him for all ordinary purposes, but for accurate work it is better practice to use poseline or mutten tailow.

Better use an extra bolt or two when bolting down a job. It is easier on the bolts, and the work is more secure.

So many mechanics confuse their "mikes" with a sump gaze!

A high-speed lathe center will outwear ten made from carbon steel.

A lead ball weighing about night pounds is a handy tool for rightoning willing arbors and end mills and setting toors firmly down on parallels in a shaper and milling machine pize.

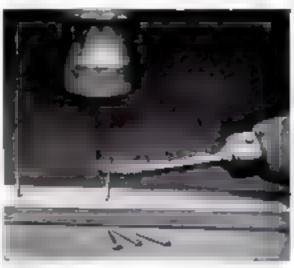
Do not grip a drill in a three-jowed type of drill-press chuck at its very and or it will soon rule the jows, Extend the drill all the may up,

It's surprising how close a pair of dividers can be not with a magnifying glass.

Welded jigs and fixtures should be heated to a semperature of 1,000 degrees Fahrenhelt and allowed to cool in the air, than normalising them.

Where heavy lathe cuts are taken preparatory to grinding, the strate put on the centers cometimes wears them and of round. It is therefore good practice to recenter such work before it goes to the grinder.

SPRING HOLDER AIDS IN DRIVING SMALL BRADS



SMALL nails and brack are difficult to hold when starting into the wood. A simple device not only to hold, but also to pick them up, is shown above. Force one end of an ordinary tire valve core spring on an awl or any other pointed tool. Pressing the free coils of the spring over the tasks as they lie near the work picks them up in a convenient position for driving.—France W. Bentley, Jr.



NEW GENERAL ELECTRIC COMPLETE WORKSHOP!

See This Efficient, Sturdy, Direct-drive Quality Machine Demonstrated. Banishes All Belts and Pulleys. Complete with Motor, Bench, and Tools.

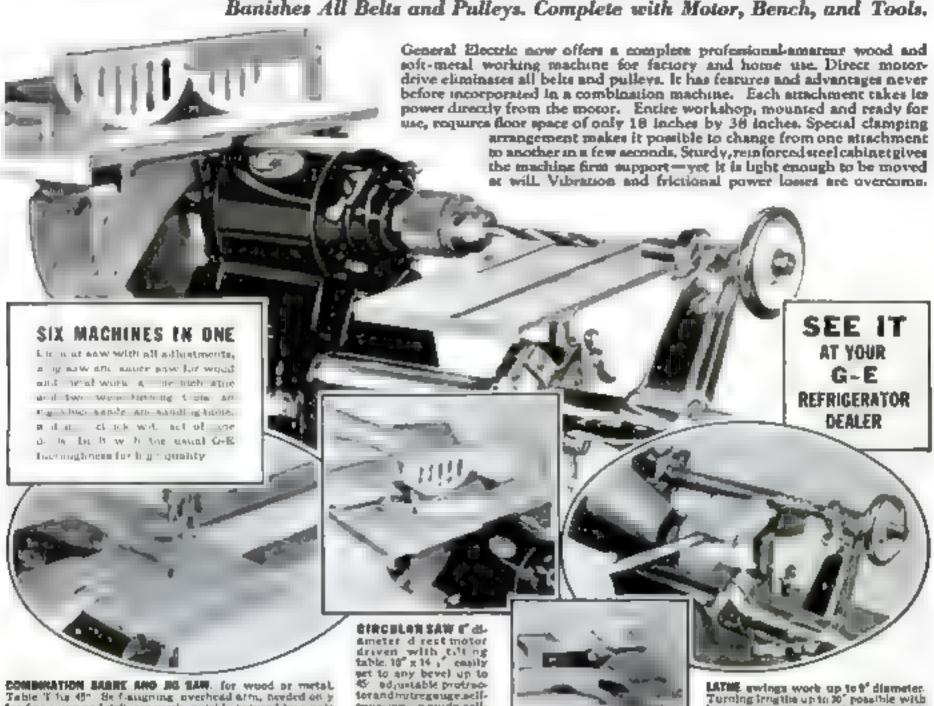


Table 'I ha 45". Se f augming overhead arm, needed on y for fine nows and delicate work, quickly secured by a nest bolt, Bow chuck holds machine files with round shanks up to seem discreter greatly increasing wide scope of ma-chine. Sebresew can be attached and to service in escounts. TACHMENT CLAMP

makes the attach-

ment of the moding

table, anbre or ut-

eaw and tool treat

a matter of a few metouds, Construc-

t on mirig d and

cousty adjustable.

COMPLETE . COMPACT

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There's Nothing Elm to Buy

Motor, bench, drill, tools are all provided, G-B introduces that machine after years of research

and development Compact high-efficiency ball-bearing motor has ha "shalt reduced to ha" at the bearings. The powerful torque and inertia of the armature assure continuous flow of power at the cutting edge. Ideal for the home crutismen, professional woodworker, or small shop. Extraordinarily low power consumption makes it the most economical machine to operate that has ever been introduced. When you see its completeness—realise that there is nothing class to buy-the astonishingly low price will truly amase you. Go now to your nearest G-E Reingerator dealer and sak for a demonstration.

equating p guide self-



SANDER TABLE INSTRUCTed for the mitre gauge and rip guide of the saw today slotted for a metal cotting saw or mill-ing curter. The 2 inch sanding disc screws directly on end of the ried by action held in

Turning frog the up to 30° possible with bed extension. The tace plate fitted with removable core of apur centers, screwii directly on motor shalt, or a carried so apecial mandrel held chuck.

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Motor Bench

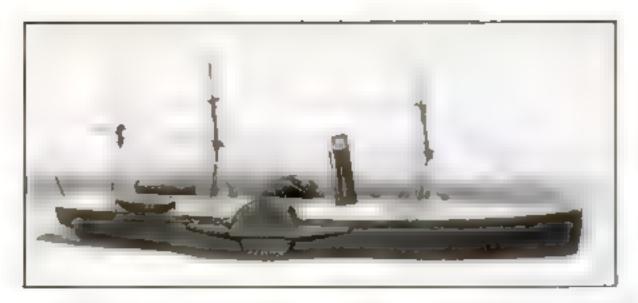
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MINIATURE MODELS OF TWO FAMOUS

Old American Steamships Savannah and Atlantic

MODEL-OF-THE-MONTH PROJECT No. 5
Designed by Theodore Gommi

Desi

The Sevenneh mode, is only 2 a a long, B S Arrance, at top of page to 5 a.

cls of two of the earliest and most famous American strainships is the next project in our Model-of-the-Month Club series. They are the Sevenness and the Attentic

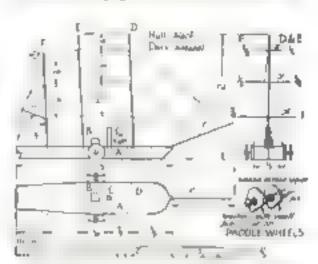
The Sargunal was the first steamship to tress the Atlantic Ocean, which she did in 1819 Only 125 ft long and of 320 tons gross burden, she was unable to carry the coal needed for steaming the entire distance, con sequently sails were used most of the time on

Manufacture Service Composition of C

Three views of the assembled Atlantic model is single partern for laying out parts A,B, B, and F, a pattern for C and detains of the paddle wheels, masts, boots, and function

her historic voyage. Eventually her marhinery was removed and she spent her remaining days as a sading vessel.

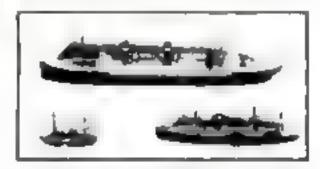
From time to time other vessels made voy ages of a more or less experimental nature, but it was not until 1840 that the first regular ocean stramship service was established by the Cunard Line. Its success aroused American ship owners, and in 1848 the Collins Line was founded to wrest the traffic from the British. Four splendid ships, surpassing the Cunarders in every feature, were built. The first in service was the Atlantic, which made her maiden voyage in 1850. The Atlantic was



The Savanuak In the bow ware, the lengths of the yards for musts D and E are given at the right and the lengths for F at the felt

of 2,860. A unique innovation in her design was a straight stern, which has since been universally adopted in ship construct on

These two water time models are made mainly of balsa wood and are on the same scale as previous models in this series of historic United States venels—I in equals 50 it. They therefore offer a remarkable comparison is the development of steam navigation. The great difference in their respective sizes gives



A striking comparison—the two early thing alongside the St. Louis, built to same scale

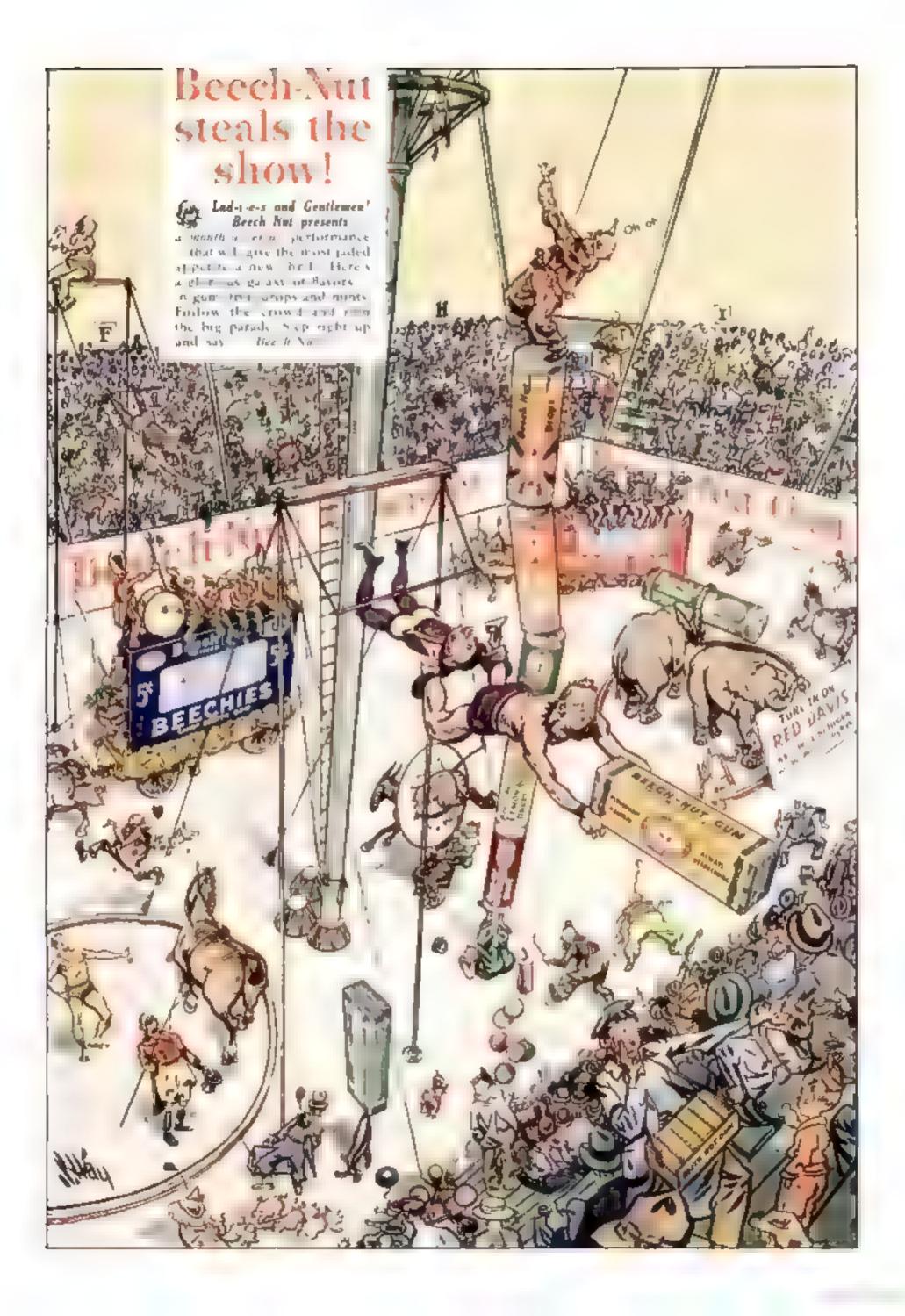
a clear idea of how much the steamship had to be improved before it passed from the experimental to the practical stage.

The accompanying drawings show the general construction and dimensions. In the Atlantic, part A is 36 in thick, parts B to H are 1/16 in thick, and the smaller fittings are as detailed. In the Sovernot part A is 3/16 by ½ by 2½, part B is 36 by ½ by ½ in, part C is 1/16 in. in diameter and ½ in. long, masta D and E are 2 in. long, and F is 1/4 in. long

A complete construction kit for making both models may be obtained for 75 cents, postpaid (see page 10). This includes the necessary balsa wood and other materials, the paints, a full-size blueprint, detailed instructions, and itemized hits of materials giving the exact size of all parts. Although the kits have been designed especially for our Model of the Month Club, other readers can obtain them, while the supply lasts, for the same price

The full-size blueprint, detailed instructions, and lists of materials are also available separately for 25 cents. Order Blueprint No. 235.

Registered members of the Model-of-the-Month Club may optain the instructions and lists free upon application by sending a selfaddressed, stamped envelope



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HORSE'S HOOF AND SHOE FORM NOVEL INKWELL

To make profitable use of his spare time, a blacksmith carves novel inkstands from black warned as shown above. The hoof is fashioned carefully by hand and bored to hold the ink bottle. A shoe is made of wood and fit ed under the bool with wooden pegs in place of regular horseshoe made. The inkwell cover is turned on a lather

Another shoe with round pegs placed in the unit holes is fastened to the back of the hoof and serves as a pen and pencil holger.—ARTHUR W. MUREAL

HOW TO MIX A SOOTHING LOTION FOR THE HANDS



An excellent hand lotion for use after working in your shop, may be prepared from glycerine, rubbing alcohol, and 🏸 dram (about 2 grams) of gum tragacanth. Place the gum in a mortar or a widemouth bottle and add 1 oz. of rubbing alcohol and 1 oz. of glycerine. Allow the gum, which is hornlike in character, to sonk for several days. Rub and pound it with the pestle if a mortar is used, or with a hard stick if only a bottle is available. The gum will swell and become muted. Now add I az. of water and let stand, with a starting once in a while, for another day. Next add 2 on each of glycerme and rubbing alcohol and about 7 ox. of water. A perfume may be mixed in, if desired, before adding the last water



You may be sure that others will give him unreadable books and unwearable haber-dashery. Let them! Here's a gift that's different! A warm, friendly, personal gift that you can watch him enjoy—from the moment he tears away the

festive Christmas wrappings. The tobacco inside—a generous Humidor-full—is the mellowest Burley that ever ripened beneath the Kentucky aun. It looks expensive—but don't let that deceive you. It costs no more than a very modest cravat!



UNION LEADER



Sea those Emering new heating stoves at your dealer's. A demonstration will give you an idea of the incremed comfort and greater convenience

Pio 002 Listed as standard by the Fees Understratery Dis-gram shows hurner hase projectors and food mank.

Hom Directo

possible with a Superfex Heet-Director. The Hear-Director burns inexpensive feet olt in a modern vaporiting burner. Any destred heat volume is at your instant commend by turning the control duk Draft regulation is automatic.

Shutter-like heat projectors (pasented) on three sides of the Superfex Heat Director make it possible to direct the radiant heat at any angle you choose.

The removable fuel tank holds oil for gleven to forty-six hours. The tank can be filled outside while the fire burns un disturbed. Connections for use with outside fuel storage are also available.

Choose your new Superfex heating store early and enjoy a full sesson of genuine comfort. There are seven models, three Hest-Directors and four Radiating heating stoves. Sizes for every stove-heating need. Prices for every purse. Hundsome porcelula enamelán jah. Send for free booklet, talustrated to color

For one-room chilly spoor, get a port-able Perfection and featuring recen hunter



HOW TO SHADE YOUR PHOTOS

(Continued from page 75)

The problem is simple where the lighting shades off approximately uniformly. A picture of a room where all the light comes from the windows along one side, or from one artificial light placed at one side, is a good example. There are two ways to do the shading

The first method is to move a cardboard or black paper shield back and forth across the negative in the printing frame or across in front of the paper on the enlarging easet as altustrated at the beginning of this article The shield should be started across from the side of the picture that prints too dark. It should be moved steadily and fairly rapidly across to the other edge of the negative or pennt and then back again. Repeat this motion during the whole period you have alloted to shading.

The best practice is to do the shading only during some definite portion of the total exposure. Try one half, and then increase or decrease the percentage if the print needs more correction or less. It often happens that only the objects at one end of the picture need shading. In such cases, the shielding card in only moved across the portion of the print that needs treatment.

A test picture is shown that was purposely taken with all the light coming from one side. Immediately below it a much better pent is illustrated. It was made by holding back the left end by the method described.

Partial shielding in this way often makes it possible to bring out the clouds in outdoor pictures. If they show up quite strongly in the negative when you hold it up to the light, you can cut a mask roughly shaped to hold back everything but the sky area. Instead of moving it across the picture area, give the normal exposure first, then hold the mask so as to hold back everything but the sky and move it in a small circle while you give an extra exposure from one quarter to one half me long me the first one

The second way to get graded shading scross the whole of the negative is to use shaded screens between the negative and the light pource in either printing or enlarging. Such acreens are easily made. Set up your camera facing a blank white wall or, better still, & large theet of clean white paper Focus on the wall or the paper and then deliberately throw the lens out of focus enough so that the grain of the paper or the terture



Shading can also be done with the aid of firms that are graded from light to dark

of the wall completely disappears. Next place a photodood lamp without a reflector off to one side so that the light on the wall is evenly graded from bright on one side of the picture area to not so bright on the other side

Operate the shutter, giving about one twentieth of the exposure you would normally give for a room under such light. Several exposures should be made with different degrees of contrast in the brightness of one end of the picture area as compared with the other II you also wish shields graded crosswing instead of lengthwise, make two exposures for each light setting, one with the camera in each position.

The reason that the photoflood bulb should be used without a reflector is that nearly all reflectors throw a bit more light into the center portion of the light circle and thus would upset the even grading of the light

The films should be developed very carefully so that they will not show streaks, spots, or scrutches. Two screens prepared by this method are illustrated. Three each of the lengthwise and crosswise graded screens will meet most requirements because they can be used in combinations.

When only a small area of the print needs to be held back, cut a mask from a small piece of black paper and skewer 2 on a piece of wire, which will serve as a shadowless handle to allow you to move the mask in a

small circle in front of the area to be shaded, as shown in the had photograph,

The size of the piece of paper and the question asto how accurately it must conform to the shape of the area to be shaded depends on the job to be done. If, for example, only a shight lightening of Lone is desired in an area approximately circular in shape, a square piece of paper will do just as well as round one, assuming that it is kept in rapid motion all the time it is in front of the print. On the other hand, if the area to be made lighter is long and retatively thin, then a piece of paper of about the same shape is best

It often happens that a small area of the print is too light instead of too dark. The solution is to use a mask or black paper or cardboard larger than (Continued on page \$7)



When only a small area of a print must be held back, a shield may be made from a bit of black paper fixed on the end of a wire

HOW TO SHADE PHOTOS

Continued from page 80,

the paper or negative and cut an opening in it of about the size and shape of the object to be printed darker. Make the exposure without the mask, as long as you have already found to be right for the rest of the picture; then move the mask into place so that the light through the opening reaches the section that needs more printing, and continue the exposure for a length of time that will depend on how much extra light is required to get the right effect. This may amount to from twenty-five to a hundred percept or more of the unmasked exposure. Be sure to keep the mask moving in a small circle six the time it is in use to avoid the formation of objectionable lipes.

FLATIRON WAX POLISHES FERROTYPE PLATES

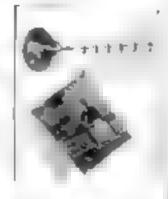


When using ferrotype places to give a lingh gloss to prints, the prints may some men stick to the tin with disastrom results. To avoid this difficulty, the plate may be rubbed with a prepared polishing solution or one made by dissolving paraffic in bename A bottle of gasoline and a flatiron waxer will perform the same function more conveniently Pour a little gusoline onto the center of the tin and spread it with the waxer. Just enough paraffin will dissolve and pass through the cloth to form a thin film. When the gasoline exaporates, the plate can be polished with a cloth in the usual manner

In place of a regular flattron water, a substitute may be made by wrapping a piece of bar paration in modin.—C Edward Lindsing

FILM-DRYING LINE HELD WITH SUCTION CUPS

AMATEUR phoingraphers will
find the line allostrated is a great convenience in drying
cut film and filmpack negatives. It
consists of two rubter vacuum cup coat
hungers (sold in tencent stores), two
wire hooks, a short
length of strong fishine, a dozen medi-



I'm sized safety pins, and a stout rubber band. The large metal books attached to the rubber cups are first removed and replaced by others of light wire. The safety pins are then strong on the line as shown. A loop is made on one end of the line, and the rubber band is fastened to the other

In use, the point of one of the pins is forced through the wet negative at the extreme corner. When dry, this perforated corner should be impreed off with about to prevent the projecting edge of the hole from scratching when the agratives are placed one on another.—Don C. Coleman

Take Snapshots INDOORS

... this Thanksgiving



Look at little Billy digging into the turkey! That's a suspency to treasure! Yet it was anapped saude the house as easily as it could be outdoors in suclight . . . thanks to super appeal film and G-R MAZDA Photofood lamps.

What is more, it was samped almost as seexpressively... because G.B MAZDA Photofood lamps are good for two hours of perture-taking... good for ducens of sedoor sampshots.

Enjoy thin first All you need is a camera with an F/6.3 lean* loaded with super-speed film, and some G-E MAZDA Photo-Bood lamps in bridge or table lamps. Then you are ready to shoot pictures of Thunks-diving fam, or of your family, friends and

parties ... INDOORS AT NIGHT!
See your druggist or pamers dealer for film and lamps. General Ricotrio Company,
Note Park, Clereland, Obio.

• If you can not tell the speed of your leas, ath your dealer. But comeron and themperates felding same or need time expansion of one or two seconds... or G. K. M 12D4. Photollank lamps.

FOR BABIES, PETS and netten plateres, use



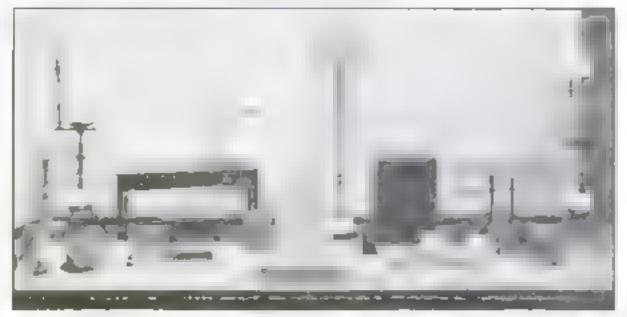
G R MAZDA Photo/lash lumps. They operate, with our noise or mass, in light packet or from Bashlight but besies. Kany to tase. Enable even bur camerus in get lively night about. Each lump gets one plattern. ISo that.

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CLUBS PLAN MANY LOCAL EXHIBITIONS

Cantinued from page 82)



This photograph and one at the beginning of the article show an exhibition of the Romacraft and Mode makers' Guild, Richmond, Va., in windows of the Methodat Publishing House

Topeka before the opening of the show So rapid has been the growth of the National Homeworkshop Guild and to important is the place it now holds in the field of amateur craftmanship that it is difficult to remark how such remarkable results could have been accomplished in no short a time. This month marks the Guild's first builday. The announcement of its organization appeared a year ago in the December, 1913 issue of Port Las Science Montally. There was then only one club in the Guild—the parent club in Rockford, Ill., where the Guild was incorporated and where it has its mational headquarters.

Not until the February have of this year was it possible to announce the first new clube to be organized, and there were only seven of them—in Topcka, Kana., Dison, III., Silverion, Colo., Cody, Wyo., Amarillo, Texas, Cincinnati, Ohio, and Fairfield, Ala, Since that time, however, thubs have been established all over the country. They are now located in 100 different times and Lowns. The complete list was published ast month. This is an extraordinary record. It means that new home workshop clubs were organized throughout the entire first year of the Guild's life at the average rate of two a week.

The regions for the great success of the (meh) are quite clear. It provides, for the first time, a national organization devoted exclusively to the interests of men who make a hobby of their home workshops. It gives them a chance to meet regularly, to see in structive demonstrations in various types of craftwork, to work together, to discuss their mutual problems, to examine each other work, and to enjoy gentine comradeship in their hubby

The fact that the Guid is entirely noncommercial and is able to provide many valuable services for the affinated clubs has contributed to the success of the movement. Its officers serve without pay, it is sponsored by an advisory council of distinguished men, it has Populan Science Movement for its official magazine, and, in addition, it publishes its own monthly by buttern

own monthly backton.

The outstanding feature of the Guild's 1935 program will be its National Exhibition and Contest, It has finally been decided to hold this event in Chicago the last week in March. As previously announced (P.S. M., Oct. '34, p. 72), \$2,000 in cash prizes and tra silver trophies will be awarded at that time. Complete details of the contest will be sent to the affiliated clubs and to all new clubs that are organized in time to take part in the competition. For information in regard to how to start a club, fill out the coupon.

CLUB NEWS IN BRIDE

Levern T Ry fer president of the Guildhas been mated to address the annual convintion of the American Hardware Manufacturers Association, which is meeting in Atlantic City, N. J., as this issue goes to press He will outline the purposes of the Guild and tell what it has accomplished.

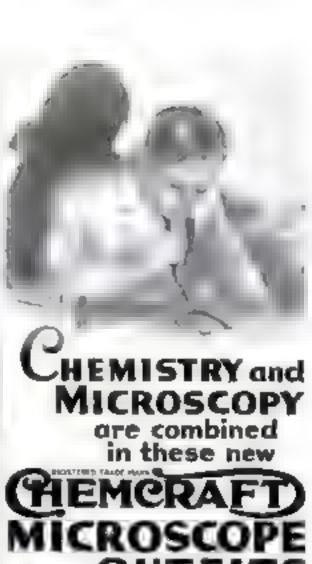
The Topcka Club held its exhibition in conjunction with the Kanses Free Fair. A continuous moving picture was presented at its booth. This showed members of the club doing various types of craftwork. E. H. Johnson, a member of the club, took two first peates for hammered brain at the fair

The Queen City Homecraft Club of Elman, N. Y., is putting on a local membership drive Prizes for the context have been donated by various local stores. A talk on scafaring matters of particular interest to ship model makers was given at a recent meeting by Lawrence Ferguson, third master-at-arous of the Southern Cont.

Members of the Homecraft and Model makers' Guild of Richmond, Va., are constructing half a dozen smoking stands and a small table for the clubs me. Its library has been established temporarily at the Y M C A., where meetings are now held. The club has staged two contests, one on bird houses, in which L J M De Jong took the prize, and another on lamps, won by G. H. Smith. The club has grown from eight to thirty members. Among them are several doctors, post-office clerks, machinists, a policeman, a watchmaker, the thief probation officer of Richmond, a Y M C A. official, an officer of a construction company, several draftsmen, and a few college students

The Creston Homeworkshop Club of Creston, Iown, and the Port Levden Homeworkshop Club of Port Leyden N Y have been chartered

National Homeworkshop Guild c o Popular Science Monthly Int Fourth Avenue, New York, N. Y i am in even in the love with high lab side and with three with he had be not the love weathing Guild was do for me. Please wed me this information in the love with addressed and stamped envelope I am inclusive. Name Address (Floure print very clearly)



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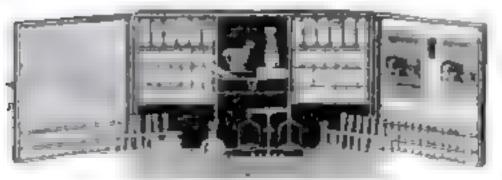
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SHIP AND COACH MODELS

Construction hits are available for some of how models. See page 10

According to the middle. See page 10 factor of the middle. See page 10 fac 1.00 30

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The Reservoir of the state of t Yacht 20-in racing 41-R

MISCELL ANEOUS

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Toy Fire Engine Pumps Water

BOYS like toys that ready work, such as the fire regime shows on our Blueprint No. 101. Price 25 cents. Then sheet a so contains drawings for a toy tractor built con rely of wood, a ings for a toy irractor built entirely of wood. It domp truck, and a sproker truck with a tank made from a tab can Another good toy bisspreat in No. 1.1. which has plant for a troy lather of II press, circular new and tointer all of which work it also come 25 cents. For girls there is the Colon at doll's house. Blueprint No. 72) with a separate sheet showing how to make suitable furniture for it (No. 73). The price of each of these blueprints is 25 cents.

THUMB TACKS SERVE AS TRIMMING GUIDES

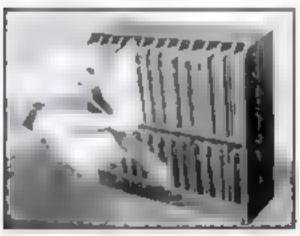


Using thereb tacks as paper guides. In this wey, film can be cut accurately in the dark

THUMB tacks used as guides on a trimming board save time and insure occuracy when it is necessary to cut a number of cards down to a specified size. This method is also useful where supersensitive photographic firm most be cut in total carkness. The illustration shows the junt on of the guides for reducing 4 by 5 a negatives to the 9 by 12 cm, size taken by a good many plate cameras.—RALPH PAGE

PHOTO NEGATIVES FILED IN CIGARETTE TINS

A CONVENIENT distproof filing case for photographic negatives can be made from old cigarette time and a wooden cal net of the type illustrated, this time is allotted to each letter of the alphabet, so any desired



This nest, distoroof and compact negative file has a capacity of more than 350 films

negatives can be found in an instant. The file shown contains about 350 negatives, from 4 by 5 in, down, and is still far from being filted to capacity. When a tin is filted, it can be replaced with an empty one and stored away—JACK FEELEY

SHIP MODEL SAILS MADE OVER WIRE GAUZE

To make satisfactory sails for small ship models, I cut them from were gause and, after giving them the proper shape, cover the gause with a then coating of plastic wood composition. Then I gradually build them up to the required thickness, let them dry, and sandpaper them until smooth. If an antique appearance is desired, a thin coating of brange shellar can be applied and immediately rubbed off as far as possible with a cloth.—Rocer B. Whoden av





Flexible Flyer

Boys and garls! Tell your father—teil your mother that you must have Fleuble Flyer. Then tell them why Tell them about the gresser safety, the steel front and bumper, the Super-Steering and Safety Runners, the super speed and the greater counting comfort. For Flexible Flyers are built with the care of a battleth p and inspected like an amplane, with perfection in every part. Look at them all—the new Astone Rucer, the assistocratic Tuxedo, the many other models and sizes of Flexible Flyer. Then take your pick!

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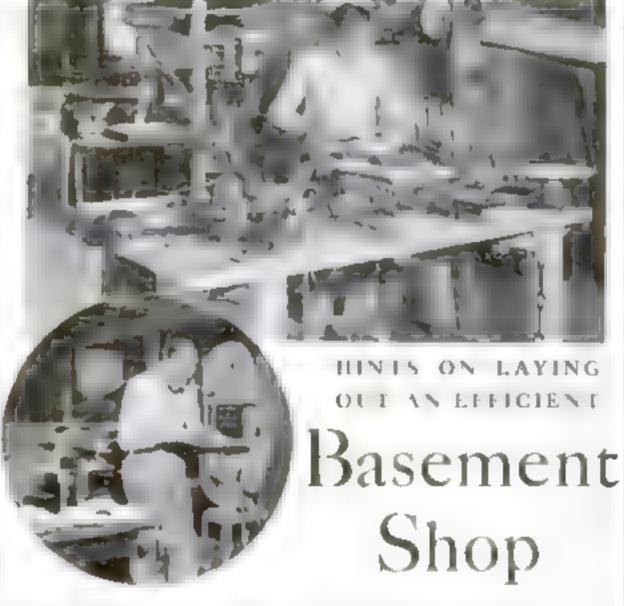
Be the in the Flexy fincer ton, the Flexible Florest series, with home very owner backes, ben best as tive subbar tires and belanced apring structure.

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of Flaxible Flyer waiting for you, free! h's yours for the asking.





HEN ample space is available for a basement shop, the problem is to concentrate the equipment sefficiently to save unnecessary steps, yet leave room enough to operate all machines treety. The shop of Lowell R. Browne, Monrovia, Calif., which is illustrated in the photographs above and the finor plan below, is a good example for those who can buy only one machine at a time. A somewhat different layout from Fig. 1 might be made, of course, if all the equipment could be bought and

instacted at once

A large homemade lathe was the first machine acquired. Then were added a binler, circular new, grinder shaper, and drill press These are grouped on a substantial bench has t as shown in his 2. Some of the machines have individual drives, but most of them are driven from a countershaft powered by a metal motor.

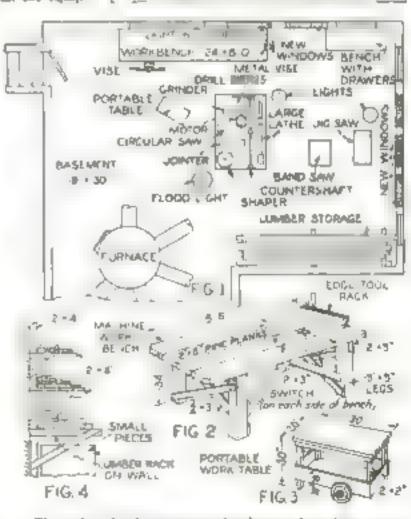
A band saw and a large tog saw have individual drives and are placed to best advantage in respect to light and handling room, A puttable worktable, Fig. 3, faculates carrying work from one machine to another. Lumber is stored on a rack built as in Fig. 4.

The artificial illumination is exceptionally well distributed, and the daylight is to be increased by putting windows in the foundation as indicated by the shaded portions of the diagram showing the general arrangement of the shop.—Hi Strier.

This is the fourth of a series of articles on laying out small shops.

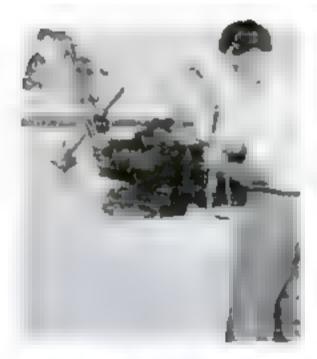
Photographs Wanted . . .

If your shop has some seatures that other readers much) profe, by please send one of a season discoverable and a diagram of he seneral layout to the Hone Workshop letter ment. The best contributions is if he and for and published



Ploor plan showing a step-saving layout of much see in a beginnest and the brock, portable table, and lumber rack

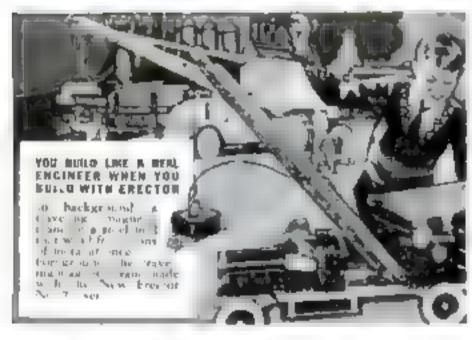




FIRST PRIZE WIN-NER LAST YEAR-Horn in Eugene White, Jr. of West Fairview, Penna with his marvelous model of an electric crone and shovel that captured first prize in the 1934 Erector Contest Look! It's no big as he is. Eugene had his choice of a free trip to any place in the United Status, but decided to use the money towards a college education.

DID MURRAY STRASBERG (Right) FEEL PROUD WHEN HE WON A CHEV-ROLET CAR!-Murray has had an Ecoctor since he was six years old. He has built models of engines, trucks, bridges and dozens of other things. "It was fun making the model of the road making machine that I won the price with," says Murray, and now I m having more fun with my new Chevry." With Butter (left) of the Erector radio programs and Casey fones, famost areater.

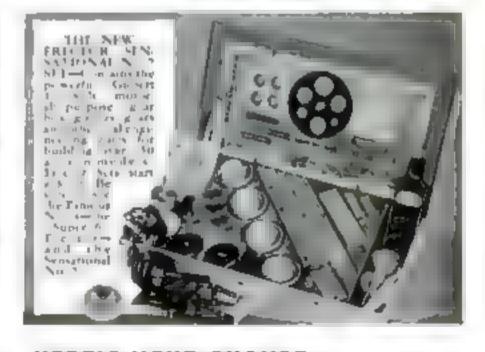




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PLASTIC WOOD

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DESIGNED IN LADDER-BACK STYLE



HERMAN HJORTH

N DESIGN this large and decorative magazine rack resembles a Chippendale sadder back chair

Cardboard patterns should first be made of all the curved parts. Saw the succes on the hand saw or with a lurning saw Before taw ing the curved rails, however, plane the ends of the board square and true

The raits are joined to the uprachts with two ,4 in dowels in each joint When the joints fit, the upper cures of the rule are rounded sligh v with fire and sandpaper and the uprich's are prooved as silven. This is easily done with a scratch stock. The sides are now ready for gluing and clamping

The next step is to jour the ends to the two sides with dowels. Cut the ends so that the grain runs borizon ally from side to side not and down. The tenter partition is joined

to the ends by zneam of stopped dado or gained joints. A groove 1/4 in, deep is cut along the center of each end piece. It should be equal in width to the thickness of the partation and should stop about 36 in, from the top of the ends. When the joints are fitted, the adea, ends, and center partition are glited

The bottom, the edges of which may be molded on a shaper or with a scratch stock, is now acrewed in place The feet should be made from one piece, which is squared to dimersions and then cut into 3-in, lengths. The pattern is marked as shown. One side is cut on a band saw to within 14 in. of the top, the other side is then cut through, after which the first cuts are completed. The legs are smoothed with file and sandpaper and fastened to the bottom with glue and screws.

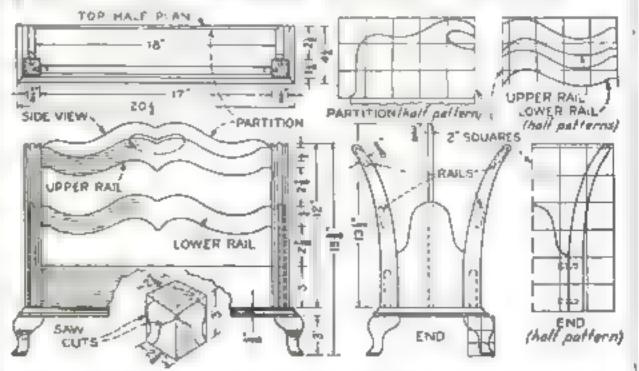
The magazine rack should now he thoroughly inspected and sanded, it is given a coat of stain and high-lighted when dry by rub-bing with No. 2/0 steel wool or sandpaper It may then be given three or four coats of very thin shellac. A 5-lb, cut of shellac should be reduced 50 percent by the addition of denatured alcohol. Rub between coats with No. 2/0 steel wool. The last coat may be rubbed to a amouth finish with waterproof sandpaper No. 5/D and crude of.

List of Materials

1 0		MM	4-1	
Pieces	Description	T	401,	2
,	Uprights (4)	1 4	415	24.5
1	Curved early (4)	-114	3	1.4
	Mea ght rails		3.	17
2	Friels		4	.5-
1	Center division	15.	18 4	N
1	Terr raps	54	6	30 3
- 1	Lep-64	129	2.5%	7 4
Noir	Dispersions are g	hen in	factor-	

INK FOR WRITING ON METAL

Whitten can be done on metal surfaces with equal parts of copper sulphate and polassum chiorate, dissolved in sufficient water to make a strong solution. A quill pen should he used. The writing soon turns into an intense, permanent black.-M. R. Y.



Side and and views, half of the top plan, half patterns of curved parts, and layout for fort

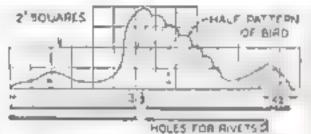


METAL BIRD IS FEEDING PLACE FOR REAL BIRDS

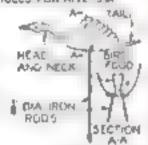
THIS unique metal bird is not only an ornament for the yard, but it also serves most appropriately as a receptacle for bird food. Hecause of its high legs, which are simply stuck into the ground, it enables the birds to feed without danger from cats.

A half pattern, as shown on the drawing, is laid out and out from heavy wrapping paper or cardboard. This is placed along a center line marked on a sheet of 16-gage soft iron 16 by 18 in., and the outline is drawn on both aides of this line. The bird is then cut out with a pair of tan shears.

Draw the lines indicating the feathers in the wings and tail, place the sheet on a flat from surface and out no these with a blant



How to lay our a pertern for mark ng the put me of the bird on the sheet con the tage, and, at right, sheetches showing the assumbted feeding place



cold chisel. Now turn the sheet around and cup or hollow the feathers with a bull-peen hammer. A hard end-wood block may also be used to support the metal.

The head and neck are cupped, and the beak is hammered into a V-shape. The body is then rounded slightly with the hammer, and the wings, tail, and neck are bent into shape

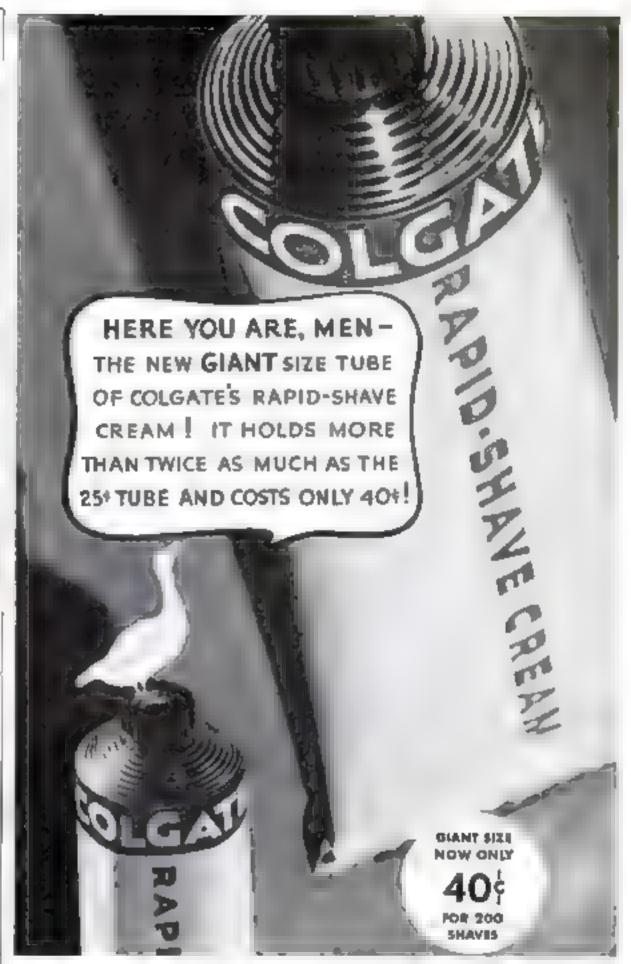
The legs are made from two 1/6-in, tron rods, 34 lst. long. One end of these rods is heated and hammered flat for a distance of about 2/4 ln. More than one beating may be necessary. The flattened ends are bent whose not to fit the underside of the bird, to which they are riveted with 1/6-in, iron rivets.

The bird may be painted white except the beak and the legs, which are given an orange or other contrasting color. The eyes are indicated with two black dots.

A smaller hird of the same design may be made for a table decoration and mounted on a suitable base.—Dark Hurringson



After the feathers have been lightly cupped, the neck and head are hollowed with a hammer



COLGATE'S DE-WATERPROOFS WHISKERS MAKES SHAVING EASIER-QUICKER!

THERE'S a tough waterproof jacket of oil around every whisker myour face. And that waterproof jacket is what makes whiskers hard to cut.

Remove that waterproofing and you'll get a shave as smooth as a husband's alibi.

But—most shaving creams don't remove all of it. They froth up into big-bubble lather—and you can't get a lot of big bubbles close around every whisker. Colgate's Rapid-Shave Cream makes small-hubble lather—whips up into millions of fine bubbles. They crowd close to each and every whisker. They strip away that waterproof coating, emulsify it, float it away.

Then—whole armies of tiny bubbles seep right into each whisker, will it, soak it soft—and make it a cinch for your razor. Try Colgate's! Get the new, enlarged GIANT tube—twice as much as the 25c size, for only 40c!



Bolt Let's turn out the lights, that, and we have this bridge looks.

Dady Say, that's great! book even more RA II. The lights make or



Bob. I'm going to be expende of a ship life that some day, And it will be painted bright sudors like this one is.

Jose Goel It looks like a real phip, with all the fighte, too.



Betty: Look, Dully, there's your house and automobile and a tralley our to ride in Buddy, Now I will build a table and chair for her, too.

• See the seven STANLO Sets at your toy desier's. Also ask him to show you the two special STANLO Sets for husbling relived stations, towers and heldges, all fully lighted for electric trains. And STANLET best recomplete Electric Light Unit for use with STANLO.



AT ALL TOY DEALERS.

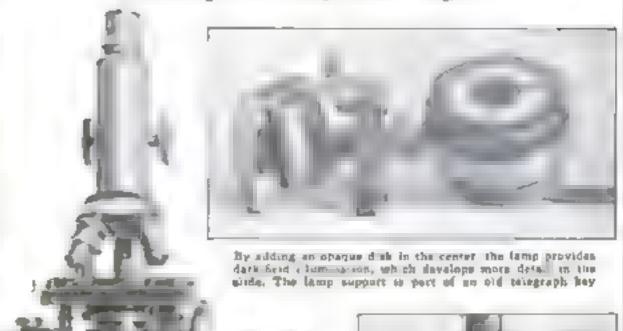
Sand coupon for been tifully colored circular

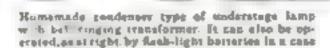
STANLO New Britain, Cono.
Please send brantifully calmed circular which tells all about STANIAI and shows what can be

> Lamp from below.diagram showing low lane is set, and disk for producing dark field

BUILD! CONDENSER TYPE With Steel-with Color Microscope Lamp with Electric Lights Made from Cheap Flash Light

Made from Cheap Flash Light



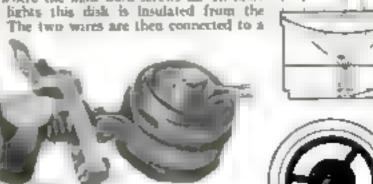


QUR lighting is the chief cause of poor results with the microscope, The condenser type of hump to be described has many advantages over other methods of lighting and can be made from an inexpensive bull's-eye flash light

The bull'a-eye lens should be removed and ground on the flat side until a fruited white color. Use the flat side of an emery wheel, and finish with emery cloth. Then grind the ions down with very fine powdered emery on a flat piece of glass to remove all stratches

If the top part of the flash light is too long to fit under the stage, it should be sawed off The bright reflector is discarded because the fern is resseembled with the round part facng the light bulb. It is suggested that a piece of blue ground glass be placed over the the sade of the lens to give a daylight effect. a piece of very fine emery cloth.

The hump is wired by fastering a small copper strip, insulated with thin cardboard, to the frame of the light. The copper strip makes contact with the soldered tip on the light bulb. The other wire is fastened to the disk where the light bulb screws in. In most flash lights this disk is insulated from the case. The two wares are then connected to a



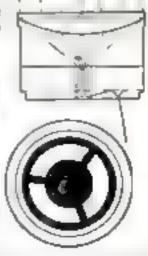
bell-ringing transformer through a variable resultance wire, or to flash-light batteries. For the interescopist who does his work in the field, a convenient way to house the flash-light batteries is to make use of the parts of the flash-light case not required in making the light

The Samhed light in this instance was attached to the microscope by using part of an old telegraph key, but one can mount the light on a neatly painted block of wood under the stage, or perhaps drill a hole under the stage and thread it, then screw a long bolt in under the stage, thus making a sup-port to fasten the light to by means of brass strips with a thumb-screw arrangement.

The dark field illuminating feature can be added by making several opaque disks. For reample, if the worker is using a 10-milli-meter objective, he should place a 16-millimeter disk in the center of the light, We med a ten-cent mece for laying out the disk,

> it is about 27 mili meters. When the disk is an place, swing the light under the microscope and von will notice that in one place the slide is brightly lighted. By moving the light alowly, the side will appear to have a dark background, yet the sode itself win be aarminated and will show more detail than with the bright light only

With this type of lamp and the dark-field disks, the amateur will be better able to probe nature's secreta.-O. M. FREEMAN



built with it.

HOMEMADE FURNACE

Continued from page 73)

screwed in. This piece of pipe had two openings, each about 1/4 in. square, one on each side, about 1 in. from the outer end. A sleeve was made to slide over these openings to control the maxture of air and gas. A pipe cap, drilled and tapped for 1/4-in, pipe, was then screwed on the outer end of the pipe

A piece of brass rod about 3 in long was then threaded with a 14-in, pipe thread on the outside for about 1.4 in, of its length. The outside of the other end was corrugated for the gas hose connection. This piece was drilled out 1/4 in, in diameter, and the threaded end was bushed down to 1/16 in, to reduce the flow of gas. The piece was then screwed into the pipe cap and held in place with a lock nut. The long running thread on this part is for the purpose of adjusting it to get the best flame in the burner.

THE top of the tee was faced off and the thread bored out. A piece of cast from was machined with a shoulder to fit over this, to hold a piece of screen and also to receive the legs that hold the crumble and battle. This ring was fastened to the tee with three 14-in roundhead machine screws. The screen is ordinary masquito betting, doubled.

The less are made of 55-in, told-round steel, heated and bent, and the lower part threaded full length with a 56-in, machine thread. This running thread is so that the less can be admited to get the crucible in the hottest part of the flame and also so the luga that hold the baffle can be adjusted to the right height. The less are locked in position with lock nuts, and the luga are also locked with lock nuts.

The bastle is made of asbestos cement. The was constructed by first bonding a tin cylinder about 1 in. larger than the desired diameter and using an old 3-ql fruit jar for a core. After the wet cement had been pounded into place, the glass jar was drawn out, and the bastle was set on top of the coal furnace in the cenar to harden. It shrunk about 1 in. in diameter while drying. The cover was usade of the same material. This has a hole in the center, about 2 in, in diameter, to allow the but burnt gas to pass out.

Any ordinary crucible, about 21/2 in in diameter by 4 or 5 in, high, can be used

OLD alumnum tranketses or flywheel taxes can be obtained from any automobile junk dealer and cut up into pieces.

The mold is made in sand in the usual way, but plenty of risen should be provided for in the mold (as shown in one of the photos) to allow the gas to escape. If this is not dene, the metal will not run properly. It takes about fifteen minutes for each heat. The mold can be made while the metal is melting.

The lamp idustrated is an example of what can be done with castings made in this way. Three standens steel rods, threaded at each end, are screwed into the top and fastened to the base with three nuts. The twenty-one glass tubes are from a dentist's anesthetic needle and had been discarded. They have rubber each that serve as gaskets. What can be described as a "one-stepped" washer holds the porceists socket. An intermediate base lamp, together with a cord and plug, completes the assembly

The subject of making metal castings in the home two-kshop was cavered in three previously published articles by Joseph C. Gibbert (P.S. M., Oct. '32, p.93, Nov. '32, p.96, and Dec. '32, p.102;

Going to build a ship model? You can save time by using one of our kits (see page 10).



"Gee!..One of the silent Coronas!"

You've now got five Coronas to at \$64.50, with the most comchoose from ! Nothing like this plete and silent portable.

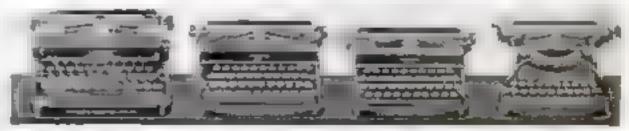
ever happened before! You can walk
into a Corona dealer's and choose
from a selection
that begins, at
\$24.50, with the
world's most famous full-fledged
portable and ends,



COCOMA SILENT Poor of portobles mode client! Standard, trauble-free. Interchangeable platen. \$44.50

Ask your dealer about them—machines at \$24.50, \$33.50, \$45.00, \$60.00, \$64.50—and about the part payment plan.

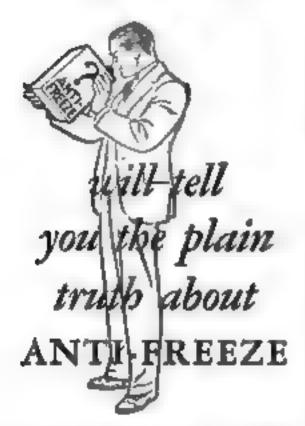
L C Smith & Corona Typawriters Incorporated Syracuse N Y



CORONA STERLING. Foor of portables, Pleases professionels. Reading Smithshift. \$40,00 CORONA FOUR, Originally \$40 DD, Fully equipped, ludividual reach edjustment, \$45.00

CORONA JUNIOR. Grand "in-between buy." Expitals and small letters; ballbearings. \$13.50 CORONA THERE, 600,000 sold at \$10. Lightest portable Dees fullsized job. \$24.50

The "NOSE-TEST"



From the standpoint of evaporation, there are only two kinds of anti-freeze—the kind that boils away ("treated" or not "treated") and the kind that does not boil away. There is no middle ground.

Make the "Nose-Test"

An easy way to make sure that you get an all-Winter one-shot product is by the lack of odor. Eveready Prestone is absolutely odorless and does not boil away—even when the engine is running at high speed.

Guaranteed All-Winter Protection

Eveready Prestone is a one-shot, guaranteed anti-freeze, that will not boil off. And Eveready Prestone is also your best defense against rusting and corrosion in your car's cooling system. It protects against rust from 5 to 20 times longer than other anti-freezes. Don't confuse Eveready Prestone with any anti-freeze containing alcohol or glycerine.

Play Safe-Save Money

It costs very little to have the guaranteed protection against freeze-up and rust provided by Eveready Prestone. On Page 70B is a chart, showing exactly how much is needed to protect your car. Also on that page note the Eveready Prestone guarantee.

TURN TO PAGE 763

COMPLETING HULL OF PRIVATEER MODEL

(Continued from page 71)

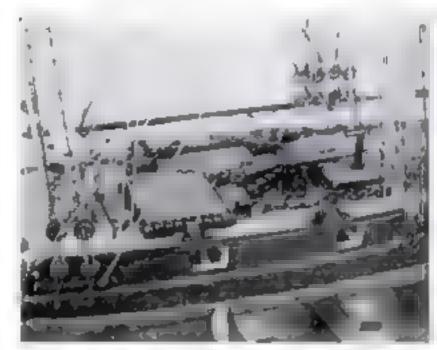
are black and the pin rails brown. The channels need an eyebolt each, and one in the forevorner of the after ones. Details of eyeboits and ringhoits are shown in the accompanying drawings. They are made by twisting the small pins to shape, or in some cases, as for the mainstavs and headgear, heavier pins are used. If you have any difficulty, make little staples.

The cutheads—the Lshaped projecting trobers
at the bow—also have to
go on. These are best set
in place before the main
or cap) ran because they
should go under it, though
in my model they cut
through it. For these try
to find a piece of twisted
grain or make them from

twig forks, although a piece of hardwood cut disconally was serve. The unsucht part lies on the bulwark against a timberhead and is nailed and glued in position. The outer end slopes slightly up and has four holes drilled in it for the cat tackle, and another inside for the stopper rope.

The boat davits, as shown in the deck plan and in two photographs used in this issue, lie on the cap rail and container the line of the sheer. They also have four holes in the ends for the boat-tackle falls.

Several boles are needed in the hall, There are boles each side for the anchor cables, called hawae boles. The position of these is



The midship section of the model. The large batch has troughs on each side for carrying ministure cannon balls

shows on the deck plan. An obiong hole is made in the stem for the pammoning lashing to hold the bowsprit down. There is a bole in the counter for the rudderpost to pass through. This must be very carefully made. It is best not to complete it until you try out the rudder for sue and position, although that shown should be right

The rudder should now be fitted. Make it to the shape shown on the sheer plan (page of of the previous issue). It is 3/12 in, thick and tapers slightly to the back, with its front edge and the edge of the sternpost slightly rounded so that it will swing. The rudder post is aquard, bending a little forward where

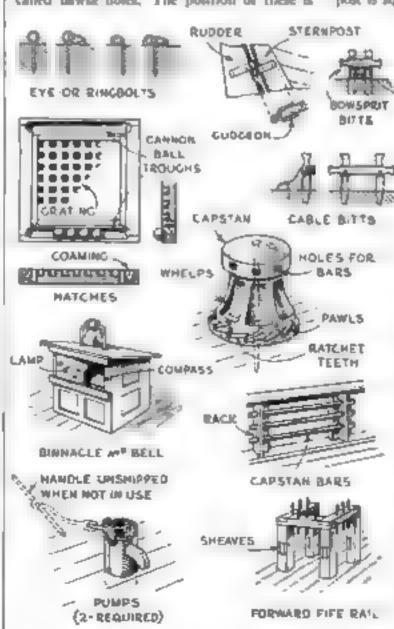
It passes through the deck. The tiller, which is mortised into the rudder sen 3 12 in from the top is 5 6 n. thick, 'p in wide and 1 3 16 in long. It is slig by curved and tapered toward the end and is set parallel to the deck and . in above it

For a simple model, nail on the rudder with (wo pointed nails, or had high through for a fine model, fit at with gudgeons and junties. The gudgeons (sockets) are of strip brain, bent and soldered around a No. 20 escutcheon pin and the pin removed. The pinties are the same, but with the pin soldered in. By careful drilling, you can rivet the strape from side to side. The rudder must be fitted close to the stempost or the post will not go through the counter. If necessary, reduce the width of the stempost alightly.

Before making the deck fittings, take a strip of paper and from the deck plan mark the position of all parts, including the masts. Transfer these positions to the center line of the deck

Forward are the cross bitta for holding the bowsprit an position. This is just a crossbar notched hadway into two uprights, which are driven into hotes in the deck and there glued. As the bowsprit does not quite come to the deck, a little block is glued to the deck between the hitts.

For this and other deck fittings, betwood, bolly, or any other wood of fine texture will do. I used degame or lemonwood through-(Continued on page 100)

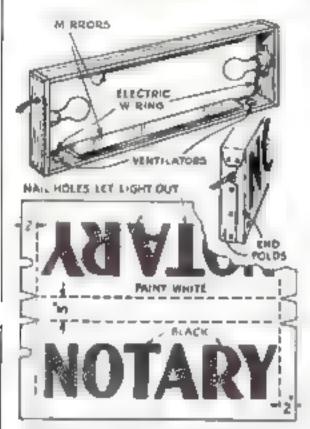


These drawings show the shapes but not the relative sizes

DOUBLE-FACED ELECTRIC SIGN COSTS LITTLE

AN ELECTRIC sign that appears lighted on both sides may be made at very little expense by the method illustrated. First prepare a wooden frame from 15 by 3 in, lumber For the sign shown, the frame was made 12 by 30 in., but it can be any desired size

Next fasten a strip of looking glass along both the top and the bottom of the frame on the inside. The upper glass may run the full length, but the lower one should be about 4 in, short at each end so that holes may be druled in the buttom for ventilation. A standard light socket is placed at each end of the



The frame with lamps and mirrors, and how the tin covering is laid out and feetened on

frame, and 15-wait bulbs are inserted. The electric cord leading to the accides comes out of one end of the frame

From a 3-gal lard can or oil can, cut a piece of lin as shown. Outling the word or words on the tin as illustrated; then key the tin face side up, on a plank and punch the letters full of hotes by driving a large nator spike through them with a hammer. Out line the letters first in this manner, then punch the centers. The lin is now best around the frame, and the ends are fastened with strews.

Paint the complete sign white and the letters black. In this way you will have a sign that will show up well both day and night There is no opening for changing globes, but it is a simple matter to unscrew one side and one end, which gives room enough to make these changes.—J. P. Kvirr.

MODIFIED SAFETY RAZOR GIVES CLOSE SHAVE

To obtain an extra close shave with a standard type double-edge safety rator, I filed off all the guard teeth on one side of the rator holder except the two end ones. I first shave rapidly with the guarded side and then finish more cautiously with the unguarded side. There is very little danger of cutting oneself because the tooth left at each end forms a satisfactory guard. It is important, however, not to remove them. Experiments made with a razor having all the guard teeth fixed off on one side revealed that the corners of the blade were likely to cause small cuts, no matter how carefully the parcy was used.—P W Cathot 8



scale model of the *New* Union Pacific Million Dollar Streamline Train!



ALL the drama and excitement of operating the new wonder train of the west is yours in this new banel Streamline for the banel Streamline is not a skimpy, dinky train—but the real thing! An exact scale-model, 46 laches long, 1-45th actual size of the 110 mile-on-hour speed wizard itself! Space here won't permit us to tell you all the fascinating things about this amazing

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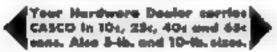
Every handyman, home-graftimen and manual-training student should have this interesting and helpful Gluing Guide. It contains desens of money-making and money-saving ideas on building, repairing and mending things easily and permanently. It tells how you can glue everything to stay glued ... an apite of moisture, heat, tough bings or plain neglect.

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į	
	(Str
Ī	P.S II 12-04

COMPLETING HULL OF PRIVATEER MODEL

(Continued from page 98)



Captain Mr. Cann Inspects the finished model, which is one of the best for has constructed

out on this model, including all the spars.

The cable bitts are similar to those described except in shape. They have knees on the fore ade as shown in the plans and de-

tail drawing. Stain them brown.

There are five batches, all the same except in size. The coamings (sides) can be square pieces of wood, sightly hollowed to take half the thickness of the gratings, or they can be built of rabbeted pieces. They are painted black. The gratings are best made of boxwood, with the cross strips half-lapped to the others, but the indentations can be punched with a square point or merely drawn on.

It gives a better finish to put troughs around three of the lutches for the shot for the 6-pounder gues, and one on each side of the large batch for the 24-lb, shot. They are merely tableted strips of a size to take the shot, with balf projecting. The size of the small shot is 1 32 in and the large 1 10 in. Comshot can be obtained in about these sizes, or steel balls made for the in bearings may be bought in a bicycle repair shop.

The capstan can be turned or filed to its outside shape and then the spaces between the whelps (see detail) due out with a tiny thack, or the whole can be built up. The pawl channel is a separate piece cut all around to represent notches for the pawh. The latter are six pin points bent over and driven into the edge of the capstan. They are to prevent the capstan from slipping backwards. The capstan may be either brown or black.

Bars are required to turn the capstan. These are in racks, three to a side, glued to the buswarks, as shown. They are actually round bars about 7 ft tong with square butts to fit in the holes in the head of the capstan. Make them look like variashed wood.

I gave the model a box-type binnack. An apright teakwood cabinet, with a sliding door in the front—that is, the side facing abult—shows a compass on one side and a lamp on the other

On this hance the bell. The photographs do not show it because I did not add of antitiquater. It is 's in buch and by its across the mouth. It can be hung on a brase were

stapic

Cable pipes to lead the anchor chains below are short pieces of tube of a size to take the chain, set just forward of the main batch.

There should be pumps on either side just abalt the mainmast authough these are not in the pictures either. They would probably be small hand pumps as shown clearly in one

of the drawings, Pieces of tube will serve, The handles would be unshipped except when

There are fife rails around both masts. Each has four posts with the toppeces half-inpped at the corners. The rails are drilled for he laying pins. The two forward posts need holes representing abcayon (wheels) for the boom-topping-lifts and gaff halyards to lead through. The forward posts at the foremast have one hole each for the topicall sheets. Do not fit these until you have bored for the masts and are sore that the laster will not touch them due to their rate aft.

Quite a number of bolts are required in the bulwarks, waterways, and deck. There is one in the waterways on each side of the gun ports, one in each timberhead beyond, four in the deck to hold the long 24-pounder down, and one in the stern for the mainsheet. There should also be one belund each gun to hauf it in with, but I omitted these.

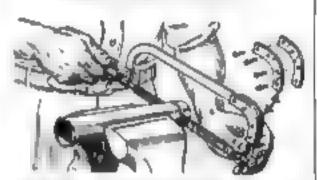
The foresheet needs a traveler, which is just a piece of wire bent at right angles and with the points driven in the deck. Thread a little ring on it before fixing

Then, of course, there's "Charlie Nobie" the galley funnel, which projects through the forward batch. It is just a piece of round stick cut on a miter, glued together, and pointed black.

The guns and carriages will have to be left to next mouth, when we shall also start

the thiging.

EXTRA ELBOWS IMPROVE HACK-SAW FRAME



Hech-saw frame with extra albows riveted on to give added weight and a firmer handhold

Rivertino an extra elbow section on each side of the frame of a hand hack saw at the forward end gives more weight and makes the blade bite into the metal with less effort. It also provides a more substantial handhold with which to push the saw downward. The extra elbows can be cut from a cheaper or a discarded hack-saw frame.—A. L. Evans

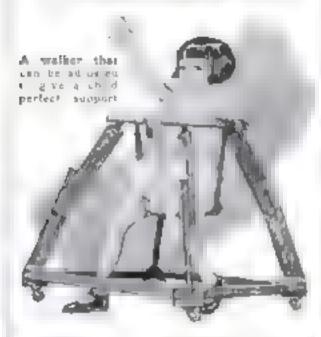
CAN LID KEEPS POKER FROM CAUSING FIRE

When a bot furnace poker is hung against a wooden coal bin or wooden partition, the danger that it may start a fire can be eliminated by nailing the lid from a various-packed coffee can or any similar type of tin cover at the point where the red-hot poker rests. The lid will hold it away from the beards. If necessary, the poker can also be bent just a bit about 12 in from the handle to keep the remainder of the heated poker from touching the wood.—Raystone John.

KEEPING SOLDER CLEAN

Ir wast or stick solder has been left lying around and is dirty. I have found that it pays to polish the end with a piece of sandpaper before using it so that no dirt will be deposited at the joint.—J E, Polisso.

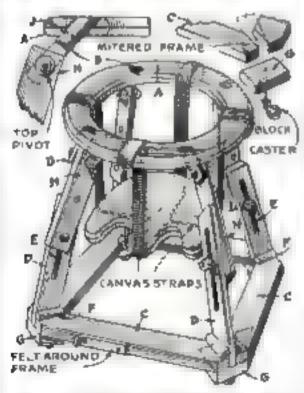
WALKER GIVES COURAGE TO HANDICAPPED CHILD



BABIES who are backward in learning to walk or children who are partially emppled, blind, or otherwise handicapped will make greater progress with the aid of an adjustable walker like that above

The circular top A is sawed from a piece of 11/4 or 11/2 in lumber 18 in. square, and four 74 in, holes are bored as indicated to receive 3-m. long pins B made from a broom handle. The bottom frame and legs are 14 by 3 in, lumber of good quality, Pieces C are 26 in. long and D may be from 12 to 16 in. long Slot E is 5/16 in. wide and 6 in. long. Lean legs D inward at the top until the opposite ones are 18 in. apart. Fasten securely and reënforce with mokling P. Add blocks G

Make pieces H 34 by 3 by 12 in. For the seat use two thin boards, nailed crosswise. Fasten two canvas strips 234 in wide and of suitable lengths on the circular top and under the seat. Let the seat tip forward a little. Bolt the upper legs to the four wooden pins, attach the upper to the lower legs with 2 by 34 in, bolts and large washers, and then fasten the ping in the circular top as at J. Add the casters, preferably with rubber tires, and apply felt weather strip around the bottom of the frame. A. C. SHUMAKER.



How the walker is assembled. The seat in adjusted by means of the two convex straps.

New Scroll Saw

Offers Amazing Performance and Efficiency



SPECIAL FEATURES

of new Delta Scroll Saw

- 1. Enables you to run fine blades at full motor speed without danger of breakage,
- 2. Tilting table turns 90° in either direction,
- L. Adjustable blade tension,
- 4. Two convenient guide positions for sawing from front or ande of machine
- L. Four speeds without moving motor.

and many other novel and useful feetures.

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New improvements and new features make the comparts 1935 Line of Their Monte De sen Trody of unusual interest to an Woodworkers. The Detta line



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If you have ever tried to make drop leaf table cuts or molding cuts on the edge of a table, you know how difficult it is with ordinary equipment.

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A. M. WINDOW SAFER, CO.

Tiny Oxcart

HOLDS POT OF CACTUS

SMALL potted cactor in a miniature Mexican oscart. forms a unique and decorative mit. The cart illustrated was seashed out on a band saw with only the roughest outlines to follow, but a jig saw would serve as well, or the parts can be easily whittled.

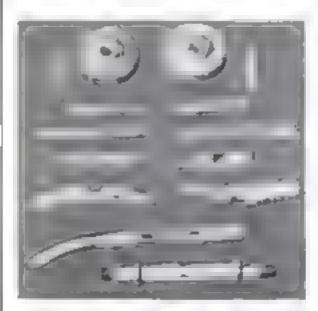
The silk are good starting parts. Notch them accurately for the axic, and hollow the upper edges about 34 in. Bore the stake holes clear through Mortese for the slats, make several crosscuts with a thin saw binde in the ends and underedges to

represent checks and groove deep cracks with a knife or V-chisel, diminishing them toward the centers of the pieces.

The two cross sills are notched at the ends and center. The pole, representing a tree limb squared along the part entering the cart, is purposely broken off and bent downward to hold the cart nearly level when in use. Mortions are cut through the pole to receive the

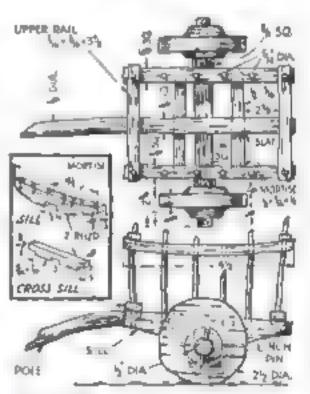
Be sure to make the rails arregular. They may how outward at the centers, as if forced out by long years of banking dye wood or

The axle is made with a square shoulder behind each journal. The wheels can be turned and afterward sawed and rasped to make them kregular, Remember to flatten them most parallel to the grain. While peeled twigs may be used for stakes, it is quicker to rip out



After being roughly shaped, the parts are alightly sharred in a flame and wire-brushed





Top and side views of the cart, and details of the mean rengthware alleg and cross salls.

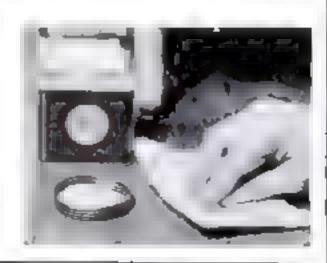
irrendar square pine strips, rounding them with a file or on a sanding dram.

Before assem a ng. scorch the ends and corners of the parts in a flame, afterward scrubbing them well with a wire brush to remove the thur Brad the main joints from below, and by way of adding realism bind some of the joints with twine to represent braided rawhide ropes.

For a finish, ordinary brown water-color paint is used as a stain. If, on drying, the unt seems too red or raw, brush on a little dull green. A cost of boiled linseed oil will preserve the wood.-E. M. L.

A MILD BLEACH FOR SPOTTED FLOORS

Owner acid has long been used to bleach or whiten discolored wood in its natural finish, especially floors. After applying this chemscal, however the wood is left so whate that the spot usually must be stained lightly to restore it to the shade of the surrounding wood. Sodium perborate, which is sold in drug stores for use as a mouth ruse and a touth powder, is a far milder bleaching agent. Although one may have to rub the moistened powder on the discoluration a longer time than if an oxage acid solution were used, the after effects are not so conspicuous. Either flavored or unflavored sodium perborate may be used. It is also particularly effective when mixed with popular parts of socilum metasticate.-R.W



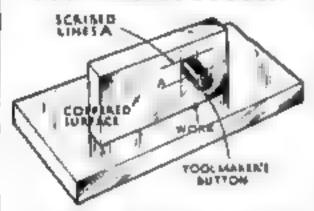
BUILDING A WING CHAIR

(Cantonard from base by)

strip of material about 214 in, wide will be about right for this purpose, and about 40 ft, will be needed to do the chair and the cushion. The welt is tacked to the very edge on the outside of the wings, to the front of the arms, above the tacking on the material already fastened to the front seat stretcher. and to the rear of the back legs and top of the chair

The upholatering material may then be cut for the outside of the wings, for the outside of the arms, from the roll down, for the back of the chair, and for the band around the front sive ther. A piece of stid cardboard is first tacked to the wings on the outside, after w. If the material is sewed to the welt with a blind stitch. The material most be turned under at the seam. No cardboard is needed at the back of the chair. The narrow hand at the borrow of the front stretcher is blindtacked, that is, the material is turned forward. over the tacks hatding it to the seat rail. The bottom of the band is tacked in the bottom of the seat rail, Next sew on the material covering the fronts of the arms, using the blind stitch. Making the embion then completes the

SCRIBED LINES LOCATE TOOLMAKER'S BUTTON



Lanes are accurately scribed on the surface. and the button is set with a magnifying glass.

WHEN a vernier height gage is used to locate a toolmaker's button accurately. much time is consumed in lapping it around. Even after it is finally located, a toolnisher often wonders if it mucht not have been accidentally knocked shift thy out of place.

The idea Mustrated gives a double check. Suppose you are using buttons of .400 in. di-ameter. With the scriber of the height gage, scribe clear lines on a coppered surface 200 in, each way from the location desired as shown by lines A. Then use a magnifying glass to place the builton tangent to the lines as

shown.

This method is especially useful for locating buttons on irregularly shaped work or round pieces, and gives about the same degree of accuracy as the height rage and indicator method It is worth mentioping again, that if the work has to be set made a few days before finishing, there is much satisfaction in being able to recherk, -- CLARRICK J. TURCOTTE.

VINEGAR CLEANS BOILER

For cleaning and removing scale from inside a bouse-heating boiler and pipes, I have been using a method that increases the efficlency of the bouer and saves coa. In the fail, after the firing senson has begun, I drain all water from the boiler, remove the steam of pressure gage, and, wang a funnel add 5 gal. of bulk yineput, which is sufficient for the average boster. The gage is then ceptaced and the hoiler filled with the usual amount of water This mixture is allowed to remain in the boder for six days of firing , then the boder is drained and flushed out thoroughly with clean water.-H. B. Kittern.

How Do I Know IT'S Christmas?"

(By A Man Who's Been Through It Many Times)

YEN without holly and tituel, trees and ornaments. I'd know it. One day-every year without fail-I walk into a roum where there are a lot of packages marked for me. After they are opened, I find myself richer to the tune of one dozen neckties and two dozen. pairs of socks, 'This must be Christmas', I say and so it is.

"Now, I know that every Christmas present comes from the heart, but I'm practical and I wish they'd put a little more 'head' in with the heart. Neckties come in such assounding colors that I'd rather pick my own. And you can't do much with Christmas socks that are a size too large or a bit too small.

"Just let me put in a word for myself--and for a couple of million other men like toe. We like Christmas presents, and we like to give them. But when we're on the receiving end of the exchange, it does our bearts good to get a really sensible gift—of practical and permanent value. Something that gives us enjoyment, something that reminds in of the giver-makes us think of him gratefully—six months—twelve months after Christmas has come and gune."

You know-without our telling youwhat a delight Popular Science Monthly, with its fascinating news and amoning photographs of scientific progress alover the world-can be to the man who wants and values a practical girt, When you make this gift-be he fasher, son, brother or friend—a year's subscription to this graphic magazine, every new issue brings him another reminder of Christmas—and another grateful thought for the friend who made so wise a selection.

While we're on the subject of gifts, we'd like to give a little Christmas present ourselves. The regular subscription price of Popular Science Monthly is \$1 50 a year-but, to every reader who wishes to send the magazine as a gift, we'll give our own Christmas present of twenty-five cents, so that, for each friend to whom you send Popular Science Monthly on this special occasion, you need send only \$1.25 instead of \$1.50. And, to carry out the spirit of the season still further, we shall mail to every friend to whom you send Popular Science Monthly as a Christman Gift, an appropriate Christmas Card, bearing your own name and your good wishes, and telling him Popular Science is coming as your gift,

If you want to send a gift that means something-and, if you want to avoid the discomforts of last-minute shopping in crowded stores - Popular Science Monthly is certamly the solution to this year's gift problem—for every man on your Christmas list. Use the convenient order blank, sending your remittance now or indicating below that you wish to be billed for the amount after the Christmas Holidays—and mail it back to us today

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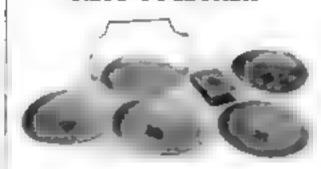
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HAMMERED ASH TRAYS **NEST TOGETHER**



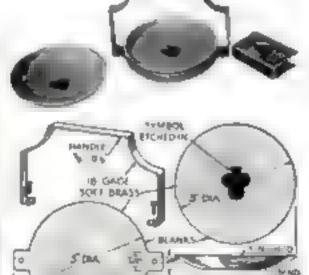
NEST of decorative hammered ash trays for your bridge table can be made quite easily from 18-gage soft sheet brans. Cut the trays 3 in, in diameter Hold one of the blanks on a smooth steel block at about a 45-deg, angle and begin haramering about 1/2 in, in from the edge with the ball end of a ball-peen hammer, driving each blow toward the edge. Cup all the branks in this way to a depth of about 14 in , then clean up the edges with a file.

Outline one of the symbols of the four suits on each piece, paint all around them with asphaitum, and set the work uside until the asphaltum dries. Etch out the design with commercial pitric acid, remove the asphaltum with kerosene, and paint in the exchines in their respective colors with brushing lacquer

The base for the nest, which is 3 in. in diameter, is made the same as the trays, except that it is not supped quite so deep and a lug is left on either side, as shown. The handle, after being cut from the same stock, is bent to shape as indicated and riveted to the lugs on

the nest with No. 14 brans escutcheon puns. The match-box holder is made from 24rage soft brass, etched and hammered, and best to shape in the vise.

Complete the set by polishing and lacquer-ing each piece.—J C. Wittrooms.



The smoking set partly nested, and drawings of the trays, base, handle, and match-lim case

N. CAGA

WA H DOS SLANN

NEST

Principle (C)

CRYSTALLIZED LAMPS

A new crystal finish for electric light bulbs, which has tately become popular for novely effects in place of the usual "frosting," can be produced by dipping the lamps in a solution of 1 pt. distilled water, I ar of pure devtrine, and as much sulphate of zinc as the solution wid dissolve. To this may be added small quantities of aniline dye for giving any desired color, although too much dye will spoil the effect. The crystal finish does not appear until the globes have become thoroughly dry. If they are to be exposed to the weather, give them a thin cost of clear incquer.-C. L.



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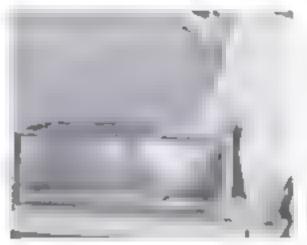
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ASSESSED WANTERS

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GLAZING AN AQUARIUM TO STAY WATER-TIGHT

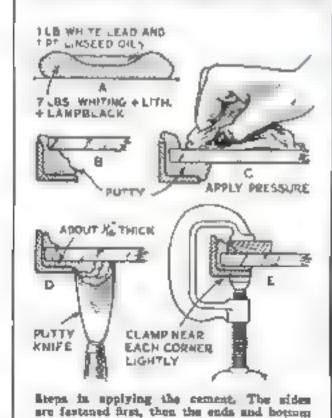


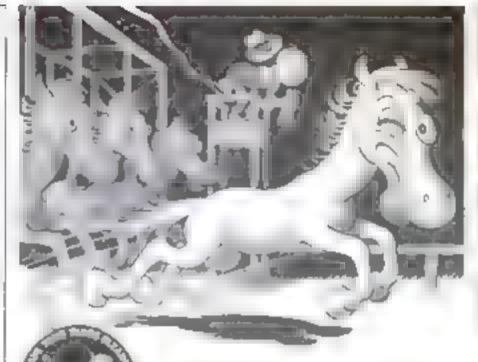
The secret of making aguariums successfully at home is to know how to coment the glass

PLATE glass can be purchased almost as cheaply as window glass in the sizes needed for making an ordinary equarium. The glass should be cut to show 1/16 in, of putty space between glass and frame and between glass and glass. For example, if you are glazing a tank that is 10 in, high by 12 in, wide by 24 in long instau measurements, and using 34-in. thick plate glass, the gase sizes used would be as follows. Two side plates (these are installed first) 976 by 2374 in ; two end plates (installed next) 976 by 11% in ; and one bot-tom plate (installed last) 11% by 2374 in. II the frame is made so that the metal members overlap, use the smallest inside dimensions in figuring the glass sizes,

The kind of cement used is very important Experienced fish ransers usually prefer one that will remain plantic indefinitely, Most commercial cements are of this type. You may 10 lbs, whiting, 1 lb. white lead in oil, 1 qt. boiled linseed oil, 11/4 tablespoons litharge, and about I tablespoon lampblack for color-ing gray (if desired). This makes sufficient to set up four or five tanks of the size mentioned shove. However, if only one is to be glared, make up at least twice the amount that you figure will be actually med.

Mix thoroughly about three fourths of the whiting with the lithurgs and enough lampblack to bring it to the desized shade of gray Make a mound of the mixture with a depression in the top as indicated at d. Now mix separately the white lead with about half the linseed oil and add it gradually to the whiting, mixing the whole mass thoroughly. Add the remainder of (Continued on page 100,









After Cleaning pew Af Method es at a hode finatsout and either. don't elean a new ing pus. restoring

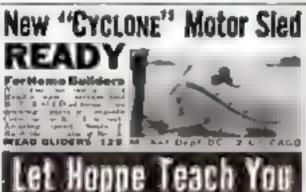
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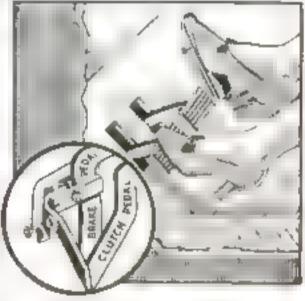
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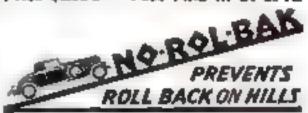
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GLAZING AN AQUARIUM

(Continued from page 105)

the whiting and linseed oil alternately in small quantities till the cement is a little suffer than window putty. Pack it in a can to season for neveral days. Knesd thoroughly just before using. Any putty left over may be kept indeficitely by storing it in the can and covering it with niled paper

The side plates should be set first. Laying the tank on its side on a firm level surface, fill the angles, as shown at B, with putty. Round off the thurp edge of the glass where marked by rubbing k with an oilstone, so that the purty will slide past the corner. Apply pressure by rubbing with a cloth as at C. until the putty film is only 1/16 in thick as at D. Scrape away the excess putty. Then, using a small C-clamp as indicated at E_i clamp the glass lightly at each corner, so the frame may be turned over and the opposite side glazed. The ends are put in next, and the bottom last. Clean off the putty marks, using salt and water, if necessary. Do not use turpentane. Block up the tank on a level surface, fill with water and allow it to set for several days, to test it for leakage. If any develops, the water must be taken out, and the glamwiped dry. The point of leakage wall then be easily visible and can probably be repaired by caulking from the outside with a putty knife. If caulting does not stop the leak, the glazing can be done over again without much trouble, if the plastic type of cement has been used.

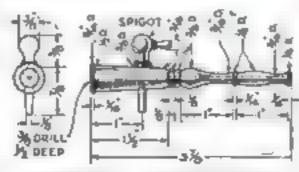
In painting or otherwise finishing the frame, do not handle it any more than necessary and never in such a way as to twist it out of shape,-Donald A. PRICE.

MINIATURE FAUCET USED AS CIGARETTE HOLDER



A NOVEL Bift for any cigarette smoker is this cigarette bolder, which has the appearance of an old-time beer faucet. To make it, a piece of maple 1/1 by 1/2 by 414 in in needed. Deall a hole L/16 in.

in diameter through the center, and at one end drill a 16-in, bole to a depth of 55 in Make a plug to fit the 16-in, hole tightly so that the holder may be turned between lathe centers. Then turn and imert the spigot, and drill the 1/16-in. hole through the spaget, The holder is given a lacquer or shellar fin-Bb.-EDWIN PURCE.



The dimensions of the holder. The hole for the apigot is tapered with a zat-tail file

TAPE HIDES KNIFE CUT IN TABLE OILCLOTH

Wirey table colcloth is accidentally slit with a bread knife or a curving knife, the cut can be repaired with a strip of surgeon's adhesive tape applied on the underside. If the tape is a little longer than the cut and the edges of the sht are drawn tightly together, the repair will be practically invisible.-- R. I.



9" a 3" Workshop" Lathe complete with re-

\$21.46 down payment, \$7.00 per month Titz 910' ewing by 5' bed "Wexinhop" Lathe is a Bacter General, Screw Cutting Metal Working Seach Lathe. Also Grand, believe Colling Metal Worling steren Lathe, 19100 uned for wood turning and machining compositions. Has power food an carriage at fine as \$50 por their, graduated composite test, \$4° to the spiritle, man meter rollest on came position test and or so ford across. Casta waves chreating 4 to 40 per met. Peace \$75 and moves, Casta waves chreating 40 per met. Peace \$75 and moves, Coher tests \$5', 4' \$0 day to 1, moves has if not serious say. Instruments ships not a (15ca Christmas gift). Write for free Copular No. 5-B.

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ROY HANCOCK

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PATTERN FOR TURNINGS MOUNTED ON LATHE

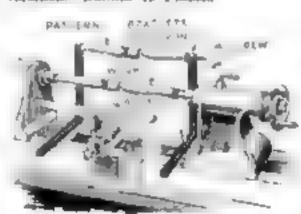


A turned master partiers is mounted directly behind the work to guide in making duplicates

QPEED and accuracy in turning a number of identical wooden parts may be greatly increased by the addition of two simple brackets fastened to the regular lathe bed. These support a turned sample pattern directly back of the rough stock. It is therefore possible for the operator to judge fairly accurately the diameter and design without calsper and ruler, except where the dimensions must be exact,

The shape and size of the brackets will vary with the make and use of lathe. Those shown were bent of 1/2-in. square rod, with 3/2-in. screw adjustments for centering

By this method I have turned as many as eight dupocate table legs without noticeable variation.- Donato R. Fostia.



How the pottern is not an brackets, which may be of any shape and size to St the lathe

STRONG WEBBING HELPS IN CLAMPING JOINTS

IN BUILDING furniture that is not rec-tangular in shape, the problem of clamping is often a difficult one Recently, while making an octagon-shaped table. I got some furnature webbing, foided it through the center lengthwise, and fastened the ends to a hand screw with blocks and screws, leaving it long

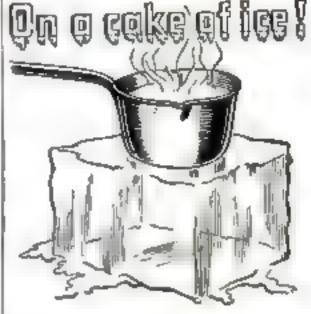
enough to reach around the framework when the clamp was open shout 8 ip. While the gived project. is drying, a support should be placed under the clamp to keep it from sagging.-R. PUTZER





Clamping the framework of an octagonal table with a hand screw and band of beavy webbing

16 16 16 16 16 16 16 18



Tr azena like black magic to some, but—a pan of clear liquid will boil merrily if placed on a cake of ice. Of course, this liquid must have an extremely low boiling point, like liquid air, at minus 318° Fahrenheit. The ice is so much warmer than the liquid air that it actually causes it to boil.

Apparent paradoxes of heat and cold are common. In Winter, if a motorist uses an anti-freeze with a hoiling point lower than water, sooner or later it boils off. Then, his car "freezes" ... that is to say: Tiny particles of ice in the radiator-core clog the circulation and cause over-heating around. the engine-head. Thus in coldest weather his car boils ... boils away the anti-freeze, and badly damages the car with host, Magic? No-carelessness!

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Read the full guarantee and protection chart on Page 76B. Here you will see how inexpensively your our can have Everendy Prestone protection all Winter long.

TURN TO PAGE 74B.

BIG NEWS

FOR MODEL BUILDERS

MECCANO

the original steel construction toy presents

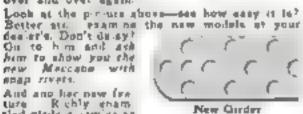
the groutest improvement ever made in construction toys



Just what you regular fellows have been wasting for Snap rivets to speed up model building. Real rivets just like the kind red blooded steel workers use. Easy to build with because you just count the holes, and shap in the rivets. Much eas at and quicker than note and boils—and the tivets can be deed over and over eggin.

apap rivets.

And any her new feeture Richly chara-aled girds a twice and bug as the old kind brittently colored a red and green. Makes madels hole like samerhing when they are completed





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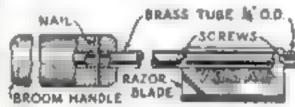
RAZOR-BLADE KNIFE FOR MAKING DEEP CUTS



WHEN making host or surplane models, a sharp, deep-cutting krafe is necessary. Most razor brade knives will not cut deep enough, but the one illustrated makes a heavy cut with safety. It will split planks to shape for model boats and trim the ends even when working with mahogany

A 5-in, paece of broom handle is rounded off on the ends and bored 21/2 in, deep to recoive a 6 -in length of heavy-walled brass tubing a in in diameter. Two botes large enough for 0-3.1 machine acrews are druied through the tubing at one end, apaced exactly 11/5 in, on centers.

With a Jeweler's saw, split the tube from the end to the back of the second hole, but at right angles to the ane of the hores Now drive the tube late the prece of broom handle. Drill a hole through the handle and tube and drive to a nail. This holder is designed to take a single-edged blade of the type that has two semicircular botches in the ends hear the back - E. F. Walnut v.



How the rasor blade is mounted. The tool in 0 in, song over all and unusually erroug

MUSLIN MAILING SACK CATCHES SAWDUST

A CONVENIENT receiver for sawdust from a small circular saw is an ordinary heavy musica mailing rack, which costs five cents and is equipped with draw strings. Merely ship the mouth over the nawdust chale and the the strang in a bow knot so that it is easy to remove for emptying when necessary - K L. Rounies



To catch aswdust, a mustis mailter sack is thad over the chate of a small circular saw

RADIO BUILDERS!!

The real intend to build any radio apparetus de-pershed in Thomas We emp Magazines as bilactics of it in we tripe july a sent to our Fitch aperta-tabilisted by all approved the for hat set. On this case tight trip expenses as he read-ing anistration is as thereto a sign a begin as your hash above of later good dependants well-field and out that what are grown as please you Whether Job that the later it are entired.

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1934 Home Workshop INDEX

EACH year the demand for our Home Workshop Annual Index grows larger. Every previous lastic has been exhausted. and we have been obliged to disappoint many readers. We have therefore increased the print order for the new 1934 Index fifty percent, but if you want to be sure of getting a copy, please send ten cents for it at once.

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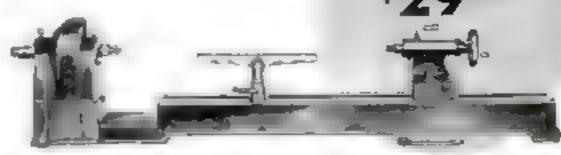
The Index is a complete alphabetical list of all the articles published in Popular Science Monthly during 1934 in reference to woodworking, craftwork, shop methods, house repairs and short cuts. boats, model making, radio, automobiles, electrical apparatus, and such hobbses as photography, chemistry, microscopy, and autronomy. It is a carefully compiled and cross-indexed key to a gold mine of in valuable home workshop reference materral. Provided you have kept the twelve passes of 1934, the Index is the one thing needed to enable you to find what you want when you want it. Without the Index, that is a difficult task, because there are almost 400 pages of this type of information in one year's magazines.

TINY CARVING TOOLS



A HANDY little tool for delicate curving, dry-point engraving, inlaying, and other fine work, may easily be made from the pencil leg of a draftsman's compass and some phonograph needles. The needles may be used as they are or ground to form chiscle or gravers. A wooden handle may be fitted, if preferred.

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Christmas Star

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paper that with an electric lamp inside and, at right, how the individoal points are made, and a parteen for the two frames 8"x 10%" CUT OUT FLADS **ENLARGED SECTION** OF EDGE CONNECTION OF TWO POINTS

MANY - POINTED Christmas star, illuminated Inside, can be made from twenty-six sheets

of beavy white paper, such as 8 by 103/2 in. typewriting paper; a bakelite electric light. socket of the kind without a switch, costing ten cents, a 25-wait lamp, several feet of lamp cord, and a plug for the cord.

Lay out and cut a short of the paper as shown at A and B, with tabe about 16 in. wide on one side and on the bottom of each triangle. Using a straightedge, fold the paper on the four long lines. Then turn it over and fold the four bottom taba back. Now paste the long side tab to the opposite side to form a pyramid, which is a complete point for the star. Eighteen of these four-sided points are

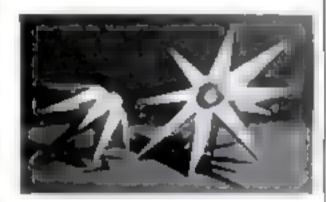
Next make eight points with only three sides. These are the same as the four-sided pounts except that one of the sides is left off

The points are fastened together by pust ing a bottom tab to the outside of an ad acent point, and then pasting the tab of that ade inside of the first point, as shown at C hasten a four sided point to each side of a four-sided point to form a cross, and then fasten a three-sided point in each of the four angles of the cross. Make two of these groups. Finally, fasten the remaining eight four-sided points to one of the above groups so as to form a complete circle

From a sheet of medium cardboard cut out two octagons as shown at D. Paste one of these into each of the groups of points, using the remaining tabs.

Splice several feet of lamp cord to the lamp socket, tuping the joint well. Open up the tip of the central point of the smaller group of points, and push the wire through from the bottom. Draw the tocket up into the point until the lamp hangs about in the middle of the star; then fasten the tip of the point firmly to the wire with adhesive tape or paste and paper, at this forms the only supend of the wire, and make sure that the lamp will burn in the socket. Hang the group of points up and have someone hold the larger group against the smaller while you tie them together by passing a long piece of white grocers cord around the star about four times un different directions.

This type of star may be varied in many ways. For instance, the star in the photographs was made by using points of different lengths. Also, colored paper or a colored bulb might be used. JAMES A. FRANKLIN.

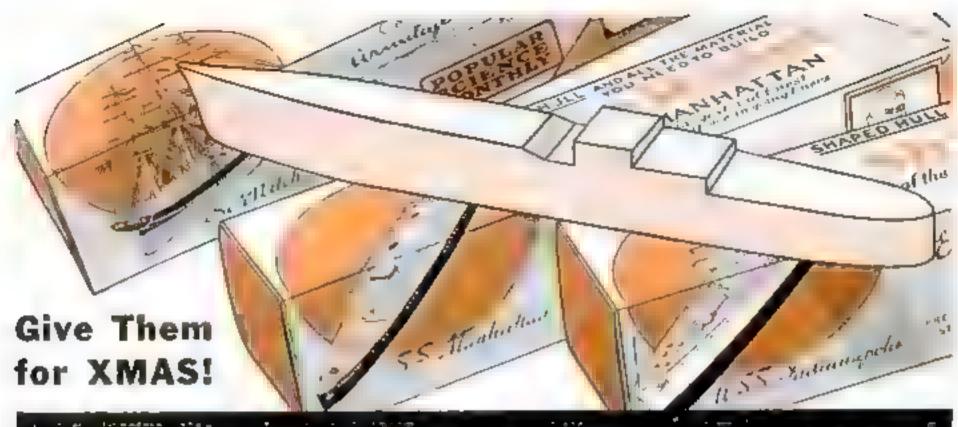


The sections before being thed together. In this case the points are of various lengths

POLISH GIVES GLOSS TO SHOE SOLES

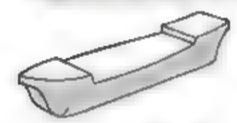


Strox sharing at home can be made more of an art by blackening the edge of the soles of the shoes as well as shiring the uppers. A simple varnish-dye for this purpose can be made by dissolving about 8 or 9 grams of borax (a scant. half teaspoonful) in 100 cubic centimeters of hot water (about 3 or) and adding 11 graps (about half a teaspoonful) of finke sheling. Stir until dissolved. This is used on brown or tan shoes. For black shoes, add about 1/2 gram (about a pinch) of water soluble mgrosine (antline black) in the heated shellar-borar solution. The resulting Squid is waterproof.---R. W.



BUILD YOUR OWN SHIP MODEL

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Sugges plan abaped half-main and after afrend's mad. Larv a fine left Top point it we to allow of musts, do h houses see

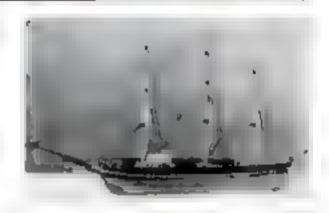
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PHOTO PRINTS DRAINED ON SHEET OF GLASS



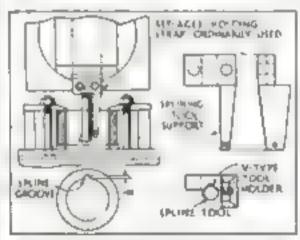
As they are raken from the fixing colution, prints are rested against the glass to drain

WHEN many photographs are developed at one time, it is convenient to rest a sheet of glass, about 15 in, square, against the made of the tank containing the firing solution. The fixed prints can then be laid against the glass, where they will adhere and drain before washing. The glass is also useful for keeping fixed prints separated from those newly placed in the hypo.- K. L. R.

SPLINING TOOL SUPPORT FOR ACCURATE WORK

EXCEPTIONALLY accurate splining can be done if the tool is prevented from springing by the use of a special support made as shown. This was designed for a commonly used type of spirming attachment which has a V-type tool holder. The original strap is removed and the tool support attached in ...

With a splining tool supported in this way a number of serrated internal taper gages



The oplining tool is prevented from opringing by a support directly behind the cutter

were made for gaging propeller hubs on a certain make of sirplane. Since no method was known by which a gaze of this type could be ground its accuracy had to depend entirely on the spaning operation. There was too much give to the tool however and consequently the gage was left be mouthed and the serrations were maccurately spaced. After the tool support was employed, each gage was found to be correct as to taper and spacine when checked with the external gage which had been ground with the greatest care to a pretreats of 2002 in .- CARL O. KLOCEARS.

RE-ENPORCING WINDOW SHADES

APPLYING a stop of thin adhesive tape to the upper edge of a window shade before it is tacked on the roller will prevent it from being torn off. White tape suitable for this purpose is inexpensive and easily obtained.



hashy at these and detendable for all general here with hors an use it as a dril press. military maritime, being mill etc. The first the you has be appeared as here about at a very like coal.

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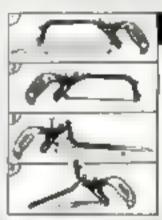


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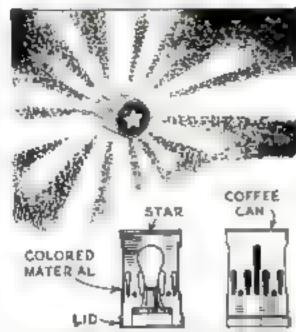
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CHRISTMAS LIGHTING

Continued from page 75.



A decorative pattern of calored light can be played on a wail by using tin-can shields

sides of the can with an old knife or similar tool. Do not make the openings too wide A star or other design can be punched in the can buttom. A combination of several of these units can be arranged

Among this year's new Christmas lighting equipment is a multiple-string bulb for tree ghting and for festoon decorations. It replaces the sense string of eight itemps formerly used, and has the advantage that when one buth burns out the remainder do not become extinguished. The multiple bulb is known as the C-754 Mazda, multiple-burning

hump, Several inexpensive outdoor lighting displays have been suggested by Robert L. Zahour, a Bloomfield, N. J., illuminating engineer. His method of making a star is to combine three multiple-type Christmas tree strings of seven lamin each. On an old table top of other surface into which halls can be driven, lay out a circle 28 in in diameter. Divide the circle into five equal parts, and drive spikes Draw lines connecting alternate points and drive spikes at the points marked 2, 4, 6, 8. 10 in the drawing of the completed star. A wire frame may be bent around these if desired, although for most purposes it will be found that the star holds its shape well enough without a frame. Fasten one of the end sockets of the first lamp string by tying the socket to spike I with a length of wire or string. Then continue to points 2, 3, 4, 5 etc., is succession, tying the sockets to the spikes. When the end of one lamp string is reached connect the wares to the end of an other string, and continue in accordance with the numbers as before. When the star form la complete, bind the wire strands between sockets with friction tape. The synkes may then be pulled out and the star removed

Construction of a luminous wreath is a sizeple matter. Suckets for green S-11 or C-913 lamps are arranged in a circle and supported by a wire hoop to which they are fastened with friction tape. The current-currying wires can be brought together at the center and connected to a flexible electric cord.

Laminous candies mounted on either side of an entrance are particularly effective. The candle proper is formed by bending a stop of red screen-wire pelatin (flexible glass substrute) so that it assumes a half-round form. This material, of course, must be reasonably heat resutant and fireproof. The edges are tacked to a wood strip 5 or 6 in. wide and 4 or 5 ft, long. Along the center of this strip. are mounted sign sockets to receive 40-watt tubular lamps or white-frosted 25-watt, T-6 lumps. At the top of the candle structure is a medium screw (Continued on page 124)



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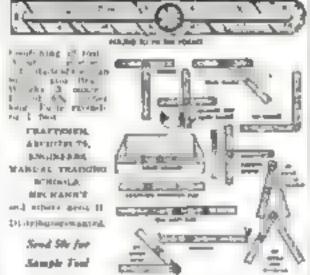
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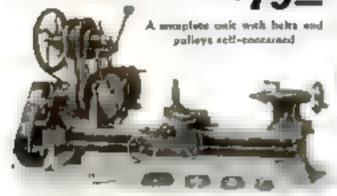
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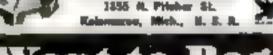


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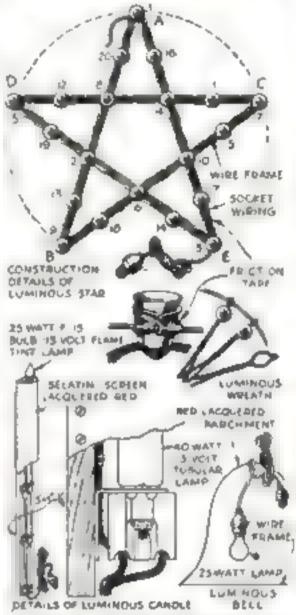
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CHRISTMAS LIGHTING

(Continued from page 1.3)

ocket for a 25 wait, F to flame-unt lamo Another effective ornament, for use at the ends of illuminated festoons, the peaks of gable cods, and the like, is a huminous bell. This is made by covering, with red-incquered parchment or colored cloth, a ware bridge lamp shade frame that is shaped like a bettsliced in two. An ordinary 25 watt lamp is suspended inside the shade.

Window shutters of the tolid type, with cut-out designs, may be illuminated by placing usuall lamps behind the openings.



Suggestions for a luminous star, wrestly, and hell, and method of constructing big candles

WORN-OUT PAINTBRUSHES RESHAPED BY GRINDING



Ozn paintbrushes, particularly the land known as such tools, can be pointed up or trimmed on a grinding wheel if the bristles are first dipped in give and allowed to dry hard. The glue is soaked out afterwards by placing the bristles in warm water













Make namely here form with this blath shade production machine mistered in blood on present his salue bearantheet solution (find a che mid size long) report from secoled P-maddle takes long report from secoled P-maddle takes provided Baltheet form select the blatheet for the mid-mid Baltheet form select the black with the withheld baltheet form in the calculation of the black with the selection of the mid-mid baltheet form the blatheet form to be blacked by the black of the black b

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SIMPLIFIED TESLA COIL

(Continued from page 66)

rig. The latter may be constructed in a few moments with the aid of a small vise, hand drill, curtain tod, four brads, and two pieces of wood, arranged as shown. The brack are spaced far enough apart to fit the inside of the tube snugly. If the holes in the middle of the end pieces fit the rod tightly enough, the tube will be held securely by friction. The end of the rod may be supported in any convenient way to steady it, if necessary

Before winding, give the tube another coat of varues, and begin when this is still tacky Puncture a small hole 1/2 in from the left end of the tube, and pass about 6 in, of the No. 28. wire through it. Then wind a single layer of wire from that point to a point to in from the other end, bringing the haal end of the wire out through a tiny hole as at the beginsing. It is best to apply a coal of variath to the tube immediately ahead of each 2 or 3 in of winding, so that the underside will be permested. When completed, the outside should he given two coats

The smembly is clearly about in the draw ings and photographs. The lower end of the secondary winding should be connected under the head of the bolt that secures the binding post on the inner turn of the premary. The upper end should be accured to the bolt on which the bed ball is screwed Make these leads as short as possible.

With coil and exciting apparatus completed. you need merely connect them up and adjust them, Few precautions are necessary. except that one should keep from touching any part of the exciting circuit while the cott is in operation. Always open the switch before making adjustments of the spark gap, condenser, or tuning coil. Although the current from the secondary of the Tesla coil is absolutely harmless and almost without sensatson, the current from the exciting circuit may give one an unpleasant job

To get the longest and heaviest spark from a Tesla coll, it must be tuned and otherwise adjusted as carefully as a radio transmitter The finer the apparatus used, the more precisely it must be adjusted, so experiment patiently to find the most effective adjust ments of the spark gap and funning coll. With one arhustment of the cop of the tuning cou, you may get no spack at all; by moving the clip merely half a turn, a 4-in, streamer may dart from the ball of the Tesla coil, and another quarter turn may double this.

BUBBLES OF ROSIN FORM ARTIFICIAL SNOW



ATTERIAL Show, which is many times more sparkling and brilliant than the usual flakes of maca used for the purpose, can easily be made with ordinary brosp rosin. Melt a few lumns in a small can cover. When it is of the consistency of thick molasses, pick up some on the end of a soda straw and blow gently to produce brustant bubbles of many sizes and shapes. After making a sufficient quantily, crash them up into small flakes.—t. G.

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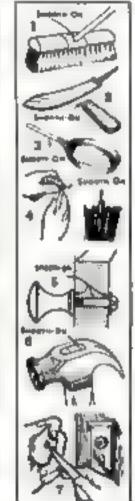
In addition to quick effective replacement of loose handles and knobs as suggested in the sketches, Smooth-On No. 1 enables you to stop leaks at cracks and joints in steam paper, radiators and boilers, in water pipes and tanks, in gas pipes, in automobile radiators, engine water jackets, bose connections and in gasoline and oil lines, to make loose bolts, muts, screws, etc., permanently tight.

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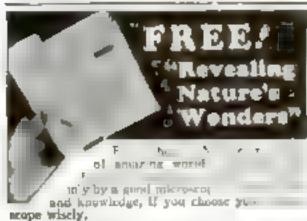
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WINS WORLD-WIDE FAME WITH MICROSCOPE HOBBY

(Continued from page 30)

that takes place unseen within the human body when the blood corpuscies battle to the death with germs of infection. Three months went into the making of this film, 5,000 feet being exposed to obtain the final 500 used

The burdest work Gravelle encounters as in taking pictures of the particles of a colloid solution. Before he can begin shooting, he has to disperse them in a film bardly thicker than the particles themselves. These bits of matter, whirling on microscopic orbits, are constantly in motion. This allows an exposure of only one twenty-fifth of a second although the particles are "kicked up" to a magnification of 1,500 diameters.

RARELY does he go beyond 1,500 diam-eters. Above it, he says, you get only "empty magnification." That is, you ged the lines a little further apart but obtain no additional detail. Incidentally, magnification refers to the number of times the diameter of an object is increased, not its even. An object magnified 1,000 diameters, increases in area 1,000,000 times. Older microscopula used to give the latter figure as it sounded more spec-

As Gravelle's apparatus accumulated, it berame scattered all over the house. Finally, it was trowding out the furniture. Two and a half years ago, when building materials were at their lowest cost, he was able to real-tee a dream he had had for years. He built a laboratory addition to his home, a long room that's five by fifteen feet, extending in-

In planning this ideal workroom, he first drew a floor plan to scale and then marked out, also in scale, all the pieces of apparatus that would have to go in the room. When he faushed, he discovered the equipment was going to 60 all the space and leave no place in which to walk around! So he had to extend the addition, increasing its length ten feet and its width five. The cost of the building was about \$4,500, With the equipment it contains, it is valued at \$20,000

As you approach the laboratory, you pue from the living room of his bome into a scientific library containing more than 3,500 volumes. Complete files of all the microscope cal magazines run back to 1868. Practically every book on the microsc pe ever pulsished is there. And cabinets along one wall hold thousands of microscopic saides for tests and comparison. No two are able and they cover a wide range of scientific fields

Reynod the Ebrury, you enter the workshop, a room filled with electric driven machinery la bes, dolls, preuson granding wheels, There are jeweler's backnaws and cabinets packed with amorted took. At one side, abelies hold bottles of chemicals, and below, a freezing outfit enables Gravelle to pregure specimens for sliting with a mini-

mum of delay

IN THIS workshop, some of the most of feet we apparatus he uses was designed and built. For instance, the vertical photomerographic camera with which most of his work in done, is of his own design. It has a window in the side which chables him to focus on the ground glass much in the manner of a photographer using a reflex camera. Other products of the bome workshop are an infinite variety of specimen holders and original gadgets for examining various materials

When you ascend a step into the next room, you find yourself in the laboratory proper. Lines of instruments like three black windrows run the length of the room, two along the waits one down the center. There are a dozen microscopes cosung from 5.00 to \$1,000 agreed. (Communed on page 117)



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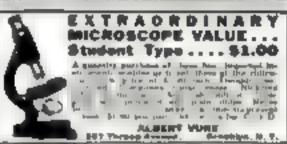
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WINS WORLD-WIDE FAME WITH MICROSCOPE HOBBY

Continued from page 116,

There are plate cameras, reflex cameras, view Cameras, stereoscopic cameras, movie cameras. There are polarized light outfits, ultra-violet light machines, cabinets of auxiliary lenses, shelves of status for specimens, tables that wind up and down like barber's chairs. For throwing pictures on the white wall which forms a screen at the far end of the room, there are still and movie projectors.

O'NE of the super-delicate machines which makes fine work possible is a microtome clicer. Each notch of its wheel represents I 25,000th of an inch, increasing or decreasing the thickness of a section that much according to which way the wheel is turned. Razors, made of special steel and costing from \$10 to \$27 apiece, do the cutting. They are honed in unique racks to the finest cutting rdge. The least duliness will pull delicate specimens apart

I asked Gravelle how many pieces of apparatus he had. He answered honestly that

he doesn't know.

At the far end of the laboratory is the darkroom. Fifteen by muc feet, it contains entargers, contact printers, ferrologic racks, an electric fun that ever on automatically when the wandow is opened, themstals, films. electric glocks, twelve kinds of darkroom lights, and even a radio that stutters when the front doorbell sings. Thus if Gravelle or Howard Somers, his assistant, are working alone in the room, they can tell if callers are at the door even if the radio is going

About a year ago, the men were working late one gight when they run into difficulties which even their elaborate equipment was not prepared to meet. Turning on the water, they saw whate suday liquid pour from the laucet. The water works, they learned later, had selected that late hour when few people would be using the water supply to dump in purifying themicals. Afterwards, Gravelle avoided that hour in developing and printing.

In 1924, less than ten years after he had looked through his first microscope, Gravelle was awarded the honor coveled by every photomicroscopist in the world, the Burnard Medal of the London Photomicrographic Society. Eight slides, together with the maximfications at which they are to be reproduced, are sent to each competitor for the medal These magnifications run from two to 1,500 diameters. Each contestant gets the same sodes, holds them two weeks and then sends them on to the next competitor. Gravelle sent them on to a man in Alberta, Canada From there they went to another microscopest in Australia

In this world-wide conspetition, the judges who examined the stides by are light in London, selected Gravelle's work as the best. He was awarded the bronze medal with the diatom on its face which is symbolic of the highest achievement in photomicroscopy. It was the first time the medal was awarded outside of England and it is still the only time an American received it

RESIDES his Fellowships in the Royal Ma-🛂 reasconical Society and the Royal Photographic Somety (gravelle has been a Fellow of the New York Microscopical Society since 1019. He is also a member of the Oueckett Microscopical Society, the American Microscopical Society, and the London Photomicrographic Society

In the thrill of exploring the unseen and bringing back snapshots of the wonders it contains, he has found enduring satisfaction as well as achievement and honors. Seventeen years ago, he put on the maste plasses of the microscope. And he has been wearing them, entranced, ever since-



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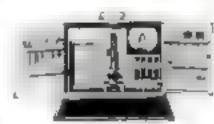
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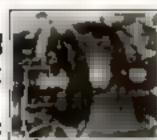
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INDUSTRY ON THE MOVE

INDUSTRY is on the move; the pace becomes faster and faster. Never before have so many revolutionary ideas been forthcoming. Tomorrow, we may awaken to find an entire industry changed, almost beyond recognition. How brile resemblance the latest model automobile bears to the car of a few years ago. How dissimilar the proposed all-steel house of tomorrow wal be, compared to the present conventional design.

Thus constantly shifting picture affords many opportunities to the man who can see ahead. Even now there are industrial innovations about to blossom forth into wide-scale use. There is a new process for fabricating steel structures by welding, air-conditioned houses are already appearing; television is rapidly approaching the standard of commercial requirements. The complete list would be both lengthy and impressive, if it were available, but many ideas are being discreetly hidden from the public eye

The man with a background of study and training in any one of the many branches of industry has an ever widening scope of activity. When commerctal aviation gets into full swing, for instance, there will be a shortage of men in several of its technical branches. What an age this is for the man who keeps in step with the procession.

Perhaps the most encouraging aspect of this age of rapid progression is the possibility of men being trained for new lines. of work when their present occupations become outmoded. Fortunately, the system of technical education is moving forward at a pace equally as rapid as that of inventive genius. One has but to keep his eyes open to see opportunities in the near future that will surpass anything we have experienced,

HE TURNED SCULPTOR

AN INEMinterior decorator was walking along the beach one day. wondering where his next meal was coming from. As he stared at a high sand bluff an idea formed in his mand and he hastened to the city council



chamber of the town, Luckity, the council was in session and he was permitted to outline his plan,

With breathless enthusiasm, he pictured the impressive (Continued on page 119)





Make Money in Spare Time

He a expressionality of Popular Science Matthir Taking spherings to be the first test grove to each unter a not be over at . It is a Popular Science Monthly, Circulation Manager, 301 4th Avenue, N. Y.

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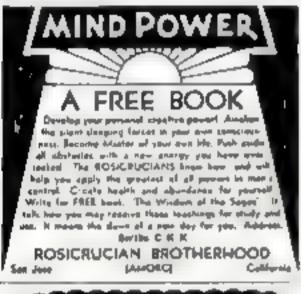


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Secrets of Success

HE TURNED SCULPTOR

(Continued from page 118)

spectacle of a huge head of Theodore Roosevelt, modeled in cement, high on the chil. The city fathers were impressed by the unique idea but stroked their chins as they pondered over the probable cost But the intrepid decorator was as practical as he was artistic. All that was needed, he explained, was a few toos of cement, he would not even require any special tools. His enthusiasm won the day

With only three tools-on are, a pickaze, and a piece of tin with which to model—he started to work, with his yourur son as a helper. As though by magic the rugged features of the great rough rider took form. People came from near and far to see the strange performance. In four days the work was finished. The councilmen were delighted. The citizens came admired and left behind them tokens of their appreciation in the form of voluntary cash contributions. The resourceful decorator found himself with money in his pocket for the first time in months. But be was not through.

Other beach towns have since aigned contracts for the modeling of likenesses. of national beroes on mountainsides and biuffs. Since his first venture he has not been dependent on voluntary contributions He now receives substantial fees from the municipalities and is once more happily employed.- J S.M., Maplewood, Calif

IT STARTED FROM DUST

BILL was trudeing along a hot, dusty road on his way to the softbail diamond on the edge of Canon City Colorado As the cars streamed by, buge clouds of dust choked him and almost blinded hum. But B II was too busy thinking



to complain. He was thinking about that dusty road. The weather had been hot and dry; the popularity of the soft-ball park was causing a steady increase in traffic. To make matters worse, there was a water shortage which made sprinking impractical.

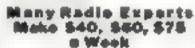
An rica was struggling into shape in Bill's mind. He had talked, that very day with trate residents along the road, who were fed up" with the almost unbearable condition. Oiling the road would cost at least five thousand dollars a mile, according to the highway department's figures That was not in the cards. But why should the cost be so high?

Materials-that was the catch. Why couldn't some cheap substitute be used? Bill imped for (Continued on page 120)



Will Train You at Home to Fill a *GOOD Job in* RADIO

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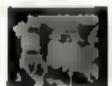
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will you be doing one year from today?

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Secrets of Success

1T STARTED FROM DUST

(Continued from page 119)

the gutter as a car whosed by. Blue clouds of exhaust smoke mingled with the dust. An oil-pumper, Bill said to himself An oil-pumper-oil-that was the answert Just plain crankcase oil was the very thing.

Bill forgot the soft-ball game. It didn't take him three minutes to reach the nearest filling station. When he walked out he carried with him an option on all their old crank-case oil. One by one, he canvassed all the filing stations. When he finished he had signed practically every one in town.

The next step was to purchase an old truck. He got one at a ridiculously low price. Being handy with tools, he soon had a home-made sprinkling truck rigged up. He started out after business. His price was a dollar for oiling the road in front of a house. The residents welcomed the chance to get a dust-proof coating for such a grnall fee. Business became so brisk that he soon found the supply of crank-case oil inadequate.

Bill had no intention of allowing this shortage to limit his business. He made a deal with the refinence at Florence to supply him with crude oil. But when be tried to use it, it was too heavy. It wouldn't flow. Again Bill used his ingenuity. He installed a beating tank on his truck and went merrily on his way. The city council by this time unable to cope with the water shortage, engaged him to oil the roads in front of vacant property

Bill is back in college now-thanks to his earmings-but you can rest assured that pext summer will find him atop his home-made sprinkler,-A.D.P., Denver,

Coro.

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THIS department will give \$5.00 for every true success story submitted by readers of Popular Science Monthly, and which is accepted for printing in this magazine.

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Manuscripts must be confined to 500 words or less. They must be true and, if accepted, authors must be prepared to give us signed statements to the effect that they are true. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected stories unless postage is provided for this purpose. Address contributions to Success Story Department, Popular Science Monthly, 341 4th Avenue, New York City.



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(Continued from page 63)

Knife-Handle Cement

W R., ST PAUL, MINN. A hard-setting orment for fastening knufe blades in their bundles can be made easily by boiling together caustic soda (one part), rosin (three parts), and water (five parts); finally adding plaster of Paris (four parts). The rement should be used immediately and cannot be saved,

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H. B., surrato, z. T. The Mapepire, or Bushmaster as it is more often called, is one of the most possonous of snakes. Often growing to a length of eleven or twelve feet, it develops long fangs capable of inflicting wounds that may cause death in a few minutes time. It is an egg-laying reptile found principally in Central and tropical South America.

Removing Rust from Tools

F D., SAVENPORT, 10WA. Small rust spots on instruments, tools, and delicate metal parts generally can be removed with a solution made by dissolving a teaspoonful of ammontum citrate to a quart of hot water Rinse the objects thoroughly before and after applying the liquid. Finally, dry the surface with heat.

Lightning's Power

C. D. S., WILLIERGTON, DEL. Lightning striking a metal structure or a lightning rod may produce a current so high as 60,000 amperes. In the instant of the flash, enough power is desipated to light 130,000 fifty-west lamps.

Wants Motor in Vacuum

A. L., MARANOT CITY, PA. Theoretically, both electric generators and electric motors will operate in a vacuum. Practically, however, there will be undue overheating caused by the lack of circulating air,

Ship's Hull Like Battery

D. T., PORTLAND, ORL, Some ships are theathed is zinc at the stern to protect their hulls from the electrolytic action of the mit water on the steel of the ship and the manganese-bronze propeller. Manganete bronze is used for propellers because it will bend and dent without snapping

In the Dark About Cats

Q.—is it less that cals can see in the dark? J K. L., Baltimore, Md

A.-Not exactly. Atthough they can see better than man in a moderately dark room, their eyes, like man's, are useless in absolute darkness. They require some light even though it may be small.

Venus Beats Out Mars

H. G., PHILADELPHIA, PA. According to the latest reports from scientists and astronomers. Venus, not Mars, is the most probable home of life on other planets. It has been estimated that the temperature on Mars drops to at least forty below zero at night,

Short or Long Pants?

E. T., BOSTON, MASS. Although our lungs can hold about ten pints of air they are filled only when we take a deep breath. Under normal conditions they hold about six pints, one post being breathed in and out every time we take a breath.

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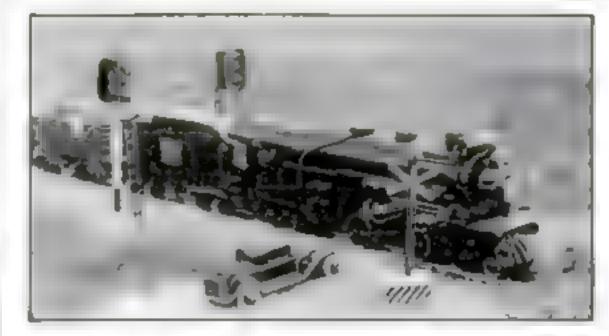
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Autor -



Highway Flasher Signal

ADDS REALISM TO MODEL RAILWAY

WELL-DESIGNED model tailroad usually includes at least one highway L crossing at grade, which, in line with modern railroad practice, should be automatically protected. The accompanying drawings show a dasher menal for an "O" gave railroad. The pole consists of a piece of 4 shoutside diameter brass tubing cut to a length of its in The cross arm is a green of a line no square brass rod 136 in, long This is boited to the pole at a height of 216 in from the hottom. Two socket shells are soldered on the underside of the cross arm, pointing at right angles from the arm. These shells may be oblained by taking agart miniature percelainhase sockets, or may be purchased at some electrical supply dealers. The lamps are minfature flash-light bulbs printed with two coots of vermison incquer or enamel. A amouth, even cost may be put on if the bulbs are kept aught while being painted.

The foundation of the signal is diamond shaped. A notch is cut in the pole 1/4 in. from the bottom, and a 3/to-in, hole is drilled through one side of the foundation to correspond in position with this notch. The wiring from the lamps then may be run inside the pole and out through the side of the foundation. If the builder prefers, the woring may be run directly out through the bottom of the pole provided connections can be made under the baseboard of the track. The foundation is lastened beside the track with wood screws.

A 3/10-in, hole should be drived in the back of the pole 5% m. below the cross arm This is for the wires to enter the pole from

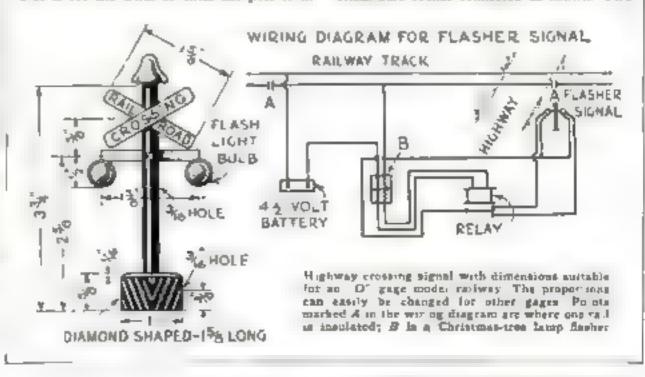
the lamps, Radio "spughetti" tubing should he used to toclose the wires where they enter and leave the pole. This gives the effect of "flexiduct" tubing used by railroads under security conditions

A crossing sign may be included on the pole. It should be fastened \$6 in, above the trust arm. The sign should be made of 20page brain cut 1/2 in, wide and 11/2 in, long. The two pieces are drived in the center and bolted to the pole with a 2-56 machine screw Fither a punnacle or a dummy bell may be added as a finishing touch at the top of the

The base is painted white to imitate concrete and his diagonal black stripes og al. aides. The pole, cross arm, sockets, and plunatle are painted black, while the sign is painted white with the words "RAILROAD CROSSING" printed in black

Three wires are necessary, one to each lamp and a common wire fastened to the pole, preferably under the bolt holding the cross arm th blace

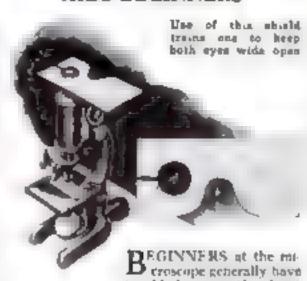
As shown in the wiring diagram, one runming rail of the track is insulated at points A One of these points should be right at the highway crossing, while the other is at a suffivient distance so that the flasher will give a realistic warming of a train's approach, B is a thermal flasher device used for making Christcom-tree lights blank. It is of the type that screws into a miniature socket, and liself includes another socket of the same type. It should be mounted by screwing it into a porcelust base socket connected as shown. Two



wires are fastened to the millet or socket end of the blinker, preferably by soldering. If difficulty is experienced in reaching the center contact to solder the connection, the same results may be obtained by carefully breaking the glass of an old flashlight bulb and soldering the two wires directly to the filament lends therein. This may then be screwed into the blinker socket. This done, it is necessary only to run the wires to the relay and flasher signal.

A train passing the insulated joint makes a connection between the two running rails. This completes the circuit and allows the battery current to flow into the blinker, which causes the relay to open and close at regular intervals. The light circuit is wired through the relay and track so that when no train is on the section, neither lamp is lit. However, with a train approaching, the lights will alternate as the relay opens and closes, giving the same blanking effect as a standard crossing signal.-T. W. Tizzano.

MICROSCOPE EYE SHIELD AIDS BEGINNERS



trouble is seeing the object without closing one eye, a procedure which places an unnecessary strain on the eyes, An eye shield remedies this, although you should accustom yourself by practise to keep both eyes open without the shield. Cut the shield out of any lightweight cardboard. Make it a rather tight fit on the body or draw tube of the microscope.--C. G. GROVER.

ROUNDHEAD SCREW USED IN DRILLING GLASS

HAVE you ever tried drilling a hole in goass? The usual methods are discouraging, but the process illustrated eliminates breakage and provides very close control of the size and shape of the bole.

The necessary equipment includes a dual press, a steel roundhead machine or wood screw having the head diameter the same as the size of the required hole, and a little coarse valve-grinding compound. Place a very small quantity of the abrustve on the head of the screw; then bring the revolving bead head down onto the glass, being sure that

the glass is held so it will not slip. The aut in the bead of the screw helps hold the abrusive, and effer running a little, the depression in the glass develops with a tiny point raised in its center, which aids in keeping the drill centered. Best results win be obtained if very little pressure is applied in feeding the drill. MARCUS D. WEERS, JR.



Set-up for grinding small boins in glass



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HOW MASTER CRIMINALS ARE TRAPPED BY SINGLE FINGER PRINTS

(Continued from page to.

surface the killer might have touched. Finality while brushing the inside of the closet door he found a print invisible to the eye. He presed the murae of his camera hard against the surface and shot. Next day the print was becauseast throughout the country.

Every month searchers compared the print with others in the files, but without result. Three years later a sailor was arrested for robbery. While making a periodic compansion of prints, a searcher came upon one which marched the sailor's right index. The prints were entarged and carefully examined. They proved beyond doubt his presence in the murder room.

FINGER PRINTerperts working under Captaits Bazir was directions make use of all known accessible aids in detecting, developing, and photographine chance prints. Those found on dark backgrounds, such as a mahogany table, are "brought out" in contrast by a gras powder a smature of mercury and chalk, highly brushed over the surface. For prints on light objects, Laptain Barrow uses what he terms a 'maric brack powder mixed in the pulice laboratories from seven parts of lamp brack two of powdered graph e and one of acacta powder. The acacta cames the compound to fluff up and keep dry.

After the print is developed in this way, it is photographed by a fixed-focus camera, held flush against the surface. Four lights within the front four corners of the camera assuminate the print. Prints on glass are dusted with light powder, then photographed against

n backing of black paper

Legal delays frequently necessitate the preservation of evidence for presentation to juries. Finger prints on glass are made permanent by flowing lentern-alide varnish over them, or etching by the fumes of hydrofluoric acid, which out away the glass between the greasy ridges to seave a permanent print. When not prepared in this manner, they are protected by small pieces of transparent film insteads down by tape.

A simple trick makes possible the photographing of prints on mirrors, despite the normal prefection of the lights. Some time ago a diamond salesman carrying \$125,000 worth of precious atoms was held up and his car taken. When the abandoned car was recovered a lone print was discovered on the rear-view marror. The police photographer dusted the print with light powder, blocked out the remaining area with printer's link to kill the reflection and took his picture without difficulty. By comparison with prints in the file, the duplicate was found. The suspect, when arrested, confened.

OFTEN movable objects bearing prints are brought to police headquarters for direct comparison with those in the files. A Los Angeles theater was dynamical and partially burned. A search of the premises resulted in discovery of a small open-mouth bottle, with a faint print of a right thumb on its side. With a file of right thumbs on his slanting searching table. Lieutenant N. F. Hopkins compared the bottle print with those of known criminals. Within ten minutes he identified the suspected dynamiter and two days later the fugility was in custody.

Lone prints, impossible of identification only a few years ago, crop up in unsuspected places and prove the guilt of persons who otherwise would escape prison. They identify dead men lying on slabs in the morgues, save impotent men from the penitentiary and place the stamp of guilt on men who no living witness can identify

The most dramatic case of which I learned

is that of a young man who was freed after serving two years of a life term in San Quentin for burglary, robbery, and assault with intent to kill. A bandit, with his but pulled far down over his face and his cost collar turned up, broke into a small home one evening. He uttered a single command to the woman. "Stick 'em up and give me your jewelry." When she attempted to escape he shot her in the back.

OFFICERS found a print on the finide of the screen frame, which he had Jerked from the window. Although none of his priots corresponded with that on the screen, the woman identified a suspect by his voice

and he was convicted.

Convinced of the youth's innocence, Captain Barlow periodically searched the film in an effort to find a duplicate of the print found on the screen. Then, as he was despuring of success, a batch of criminals' prints arrived from an Eastern city. Among them was a set from the fingers of Earl M Carrol, a as 'The Weaset' His right index finger matched the screen print! (arrol was estimated to tallforms and convicted, James Preston was pardoned and released and (arroll, identified by a two-year-old print, took the innocent man's cell in prison.

Again, a single print saved three men from possible prison terms, or hanging, in a murder case. A liquor dealer was killed and his wife seriously wounded as they lay amorp. His niece told officers she recognized one of three hijackers when he entered her room. The three men denied their guilt, but in view of carrier threats against the dead man, they were held in Juli. Three days after the mur-der Captain Barlow searched the premises, On the right side of the barrel of the shotgun used by the fuller he found an impresnon of the left ladex finger. It did not belong to any of the three suspects, nor to the deceased or his wale. As a matter of routine elimination, Barlow took prints of everyone who had access to the room. When comparing them with the print on the gun, he found it beloaged to the alece. After subbing a story of thwarted love the confessed and the three unhappy suspects were recessed

An aged man arrived in Southern California one autimn day, planning to spend his deciment of years on the proceeds of his modest fortune. In a small park he met a fine polining young chap who regared him with aiones of easy wearsh. A few days later the chance acquaintance was enriched several hundred donars by the sale of an enchanted moneyman ng metal box. By the simple expedient of turning a crank, a dollar his inserted at one end of the box emerged from the other as a twenty. After the machine changed hands, though, it refused to function.

The RE were no witnesses to the transattion. The old man could give only a measure description of the sharper. Here was a case that rooked hopeless. Then the finger priot experts got busy. They found several impressions on the polished metal surface. All belonged to the old man. Then, almost sliding off one edge, they obtained a faint print one that did not match with any finger of the purchaser. Experienced searchers identified it as a right middle finger. They went to the proper file, extracted a handful of cards and found its mate, the print of a known confidence operator. Next day, detectives surprised him while working on another intended victim.

From many odd places the telitale ridges march into the files, sooner or later to trip up an unsuspecting carminal. Time Study Engineering

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SIMPLE WAYS TO COLOR IRON AND STEEL

As A VARIATION from the usual meth-ods of finishing decorative metal parts, screws, hinges, and other fextures, it is possible to apply simple plating or coloring solutions that protect against rost as well as add a distinctive appearance. The solutions are used with a brush, and special tanks or elecirical outfits are unnecessary. The metal surfaces, of course must be clean and free from oil or erease

A solution that will plate iron or steel with copper is made by dissolving in each ounce of distilled water the following chemicals: 50 grains of copper sulphate, 10 grains of iron chloride, and 10 drops of hydrochloric acid. After being plated by this method, the surface may be further changed in color Rubbing the metal with sulphur, for example, will give a deep black (copper sulphide) A deep blue to blue-black, according to the length of treatment, may be obtained by dipping the coppered metal in a kot saturated solution of sodium hyposulphite (common "hypo") with three drops of hydrochloric and added to each ounce. This is a good imitation of blued gun metal. If a saturated solution of potassium ferrocyanide is applied, the copper finish will be changed to a permanent red color that may be used in place of Chinese red enamel When one or more drops of hydrochloric acid. are added to the potassium ferrocyanide solution, the result will be a rich purple, the exact shade of which depends on the amount of acad used.

These solutions are mainly applicable to iron and steel treated with the copper solution. A black color may be obtained on other metab by using a solution of equal parts potassium chlorate and copper sulphate. Dissolve each themscal in distilled water and then mix the two thoroughly together .-GLOSGE S. GREEKE.

HOW COLLECTORS CLEAN OLD POSTAGE STAMPS

MANY postage stamps that come to a col-lector can be much improved in appresence by a h tie judicious cleaning. This also mereases their potential value.

Heavy cancellations are the commonest disfigurement. They can be reduced by a gentlewasting with soap and water applied with a soft paintbrush. It is of course a command oflense to remove the cancer ation completely as well as being decidedly bad form among

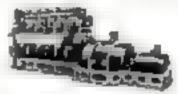
phystelists.

For spots and stains, rhemicals have to be used, but care must be taken not to try anything that will change the color of the ink or paper, If possible, testa abould be made on a damaged stamp of the same issue. Hot, or even boiling, water will often dean stamps effectively. If they are genuine and have not been repaired, they should stand boiling. Certam stamps are printed in soluble ink and these, of course, will not stand even cold water Other stamps, but not many, are printed on a double paper, and the two paper layers will separate if the stamps are wetted.

Paint spots generally yield to turpentine, Buttermilk will ordinarily take of dark stains on the back of the stamps where the traces of pum have been attacked by mildew. A mild mixture of lemon juice and salt in recommended for rust and for rule states. Carbon tetrachloride may be used instead of indammable bename for watermark detection. Hydrogen peroxide will restore the normal color to stamps that have become mudized. Soak a stamp well in two or three baths of clear water after using any chemical treatment. Grease spots can generally be removed by means of a sheet of blotting paper and a hot iron.-Docalas Leichmas

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HOME ANALYSIS OF EVERYDAY SUBSTANCES

(Continued from page 57)

solution. A confirmation of the caustic lest will be obtained if the red solution now becomes water-white.

That mercurochrome contains mercury can be readily demonstrated by heating a small quantity of the red biquid with dilute sulphuric acid and then immersing a bright strip of copper in the solution. The mercury present will amalgamate with the copper.

AN IMPORTANT qualitative test, and one that every chemnt should be familiar with, is known as Marsh's test for arsenic. This test consists of generating hydrogen gas in the presence of the material being tested. If arsenic is present, the hydrogen will cutshave with it to form amonic hydride, or arane gas, which when allowed to decompose under the right conditions forms telltale metallic

The material to be tested, such as a tonic or horneultural insecticide suspected of containing arsenic, is placed in a flask along with some pure zinc. Dilute sulphuric and is then added to the anixture. This produces hydrogen and arsine gas, if arsenic is present. The maxture of gases is then passed through a drying tube containing lumps of calcium or calcium chloride and finally through the tip of n glass medicine dropper

Allow the gas to issue from the tip for several manutes. Then apply a match to the small jet and light the gas. Foraits hold a cold porcelam surface, such as the bottom of a inhoratory evaporating dish cooled by holding a wet wad of cotton on the issade, so that it comes in contact with the tlay flame. If arsenic to present, it will be deposited on the porcelain as a shiny black coating,

Since antimony as well as asseoic might cause the formation of this black spot, a secand and confirming test must be performed. This is done by pouring a fresh solution of bleaching powder over the spot. If it dissolves, the coaling was metallic amenic

When performing the Marsh test for the first time, the home experimenter will gain experience by testing some compound already

anown to contain arresist.

Another method of carrying through the arrience lest consists of passing the gaspes insuing from the generator first over leadacetate paper and finally over strips of paper which have been souked in mercuric chloride solution and allowed to dry. Used in place of the calcram chloride in the drying tube, the lead acetate paper removes any impurities in the form of hydrogen sulplude from the pases before they are exposed to the test papers. If the mercuric chloride papers turn brown, arsenic is present. This is known professionally as the Guizeit's arsenic test.

Since both tests are extremely delicate, it is important that only themically pure pinc beused in the preparation of the hydrogeo. However since paire nor is not readily acted upon by acids, a small particle of cupper, or better still a drop of copper sulphate solution. should be added to hasten the reaction.

"HE secret of baking powder is its ability to give off carbon dioxide which in turn makes the dough rise. The amateur chemist can perform an interesting experiment by testing the gas-generating quality of the brand used in his lutchen. Using a small quantity of the powder-a level teaspoonful will be sufficient-in a flask and adding water, the liberation of the carbon dioxide can be watched and the quantity measured through | the use of some collecting device. For this a pneumatic trough, such as recently described (P. S. M., June '33, p. 48), can be used, the gas being measured by holding a scale along the edge of the (Continued on page 127



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HOME ANALYSIS OF EVERYDAY SUBSTANCES

(Continued from page 236)

collecting bottle. By a simple calculation, the entire volume of gas can be gaged.

Baking powder is composed of one of several aciditie compounds, bicarbonate of soda, and starch. The starch is added to the maxture, not as an adulterant, but as a means of preventing the granules of active ingredients from abstracting moisture from the air The starch costs the granules and blankets out the moisture, thus preserving the strength of

IF HE desires, the experimenter can test for the presence of starch in busing powder or any other starch-containing substance such as potato, pudding powder, or bananas. Shake a bit of the substance being tested in a test tube of water and add a drop of indine. If the characteristic blue color of the starch test

appears, starch is present.

By following the list of ingredients given on the baking-powder box, the amateur can perform many other interesting tests. For instance, if it is a phosphate powder, the presence of combined phosphorous can be detected by heating a small quantity of the powder with five or ten cubic centimeters of weak nitric acid and filtering the solution. If a yellow preripolate is formed when several drops of ammonium molybdate solution are added to the filtrate, it indicates phos-

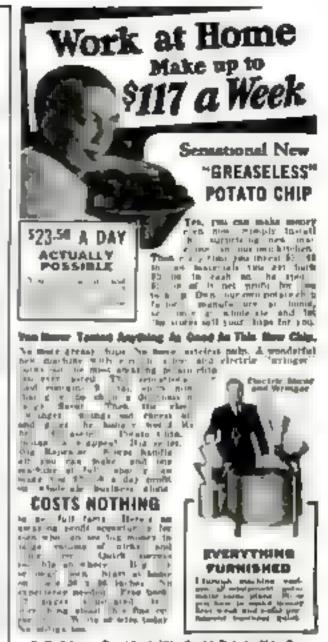
Similarly, aluminum can be detected by adding ammonium hydromde to a fresh batch of the acid filtrate. This will produce a white jellylika precipitate of aluminum hydroxide if alumnum forms a part of the original

Tartane and themise can be identified by shaking a quarter tempoonful of the baking powder with water and filtering. To about ten cubic centimeters of the filtrate add several drops of ammonium hydroxide and again. shake. Finally add several timy crystals of silver nitrate and, without shaking or disturbing the container, place it for arveral minutes in water heated to about seventy degrees Centigrade. The presence of a fartrate will be indicated by a gray, almost black, precipitate of metallic silver. Often, the free silver will cost the inside of the test tube to form a marror-like surface. If it does not, it indicates that the presence of sodium (or calcium) phosphate has prevented the formation.

Although to most of these tests we have confined our discussion to specific materials, they are by no means limited to these uses. The starch test, for instance, can be used to test almost any substance for starch, the todine test for any todine compound, and the phosphorous test for any material containing phosphorous. Try them on any of the liquids or solids in your medicine cabinet. You will be surprised at what you will find,

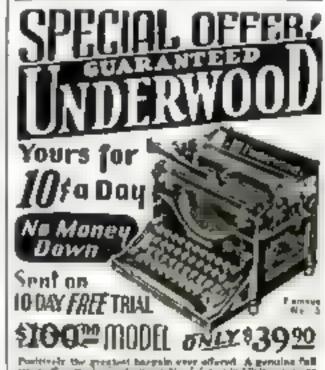
ELEMENT RARER THAN RADIUM IS ISOLĀTED

Protectivities, a radioactive metallic element razer than radium, has at last been inolated in its pure form by Dr Aristed von Grosse, young research associate in a Chicago of company laboratory. The element, known as number minety-one, is obtained from prichblende and gives off emanations identical with those discharged by radium. It is so rare that only one part is contained among 10,000,000 parts of pitchblende Protactinium disintegrates into attinuous, knowa za element aumber eighty-nine, which is said to be more than 140 times more active than radium. Both protectinsum and actinium are expected to be as useful as radium in the treatment of cancer Protectimium may be obtained at a lower cost than radium.



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FIRE AT SEA CHALLENGES SCIENCE

(Continued from page 17)

bridge can see it from almost any position.

During the six years from 10 5 to 10 4, there were 100, three on American owned merchant vessels. The total loss was 5 100,-44. According to the best available figures, there were an average of \$36 fires a year on ocean vessels during the half decade from 1020 to 1025. Of this total, seventy-one per cent, or searly three out of four, started in cargo holds and storerooms. Universal use of automatic pas equipment promises to go far in eliminating such fires.

BUT not all marine firm begin in the hold. Those that start in the upper part of the stap, and especially in public rooms, demand different treatment. To combat them, a store of innovations are proposed. One inventor has brought out a door hold-back with fusible links. In case of fire, these links med first and set the doors swing shut, thus cutting off air currents that would fan the fire. Thermostatic sharm systems, which go off when the temperature in a stateroom rises above the danger point, are being designed for ship use. Connected with five bradquarters on the bridge, such systems would automatically sound a going and flash on a red light to include the point where the fire is starting.

Light-weight automatic sprinkler systems, such as are installed in public buildings, are under construction for ocean craft as well Moldings, wardrobes, beds, wastebaskets, all of frequent metal but grained to match the wood effects of the room, are available for use on ocean biners. Stateroom partitions and doors are being designed with bollow metal tors or with sheets of steel laminated on ashestes or composition cores. Where a wood-public effect is required, coatings of vencer, one hundredth of an inch thick, are placed over cores of freproof construction. Such in novations form valuable advances its eliminating the fire huzard from sheet.

In the just the fact that the public seemed to favor vessels built and furnished like hotels, with high crownes, wood panets, draperies, wooden furniture, rues and uphobarry all inflammable, has hindered the construction of completely fireproof ships. Now, with travelers demanding safety, vessels which will be practically immune to fire are likely to make their appearance.

One school of naval architects maintains that the substitution of steel for wood in staterooms and public places will make the ship top-heavy. Another school contends it can be done with perfect safety by making a few slight alterations to the vessel's desert

In New York City, George G. Sharp, soled naval architect and a member of the Manne Committee of the National Fire Protection Association, has worked out designs for a fire-proof alop which will cost little more than a similar ship of ordinary design. By an ingenious arrangement of staterooms and by high efficiency in construction methods, he cuts out much of the trad nonal waste. This money he spends on fireproof bulkheads, doors, partitions, and furniture.

In THE ordinary vessel, bulkheads rise from the bottom to the first, or bulkhead, deck. In Sharp's design, they will continue clear to the topper deck, forming fireproof walls at intervals of 130 feet or less, dividing the ship into compartments within which first can be fought without danger of their spreading. Special doors, leading through the bulkheads, will be formed by heavy metal abelis filled with fire-resisting, non-conducting material. They can be opened or closed, in an emergency, from the bridge

All vertical shalts, such as those needed for elevators, hatchways, ventilators and stair-

ways, will be enclosed by insulated steel partitions. In order to reduce the openings in the builtheads to a minimum, the ventilating system will be had out in units, the electric fans and other equipment being fully contained within each builthead-enclosed space. All ventilator motors can be shut down at once from that points remote from each other on the slup. Thus, the officers can cut off drafts within a section even if they are unable to enter it.

THE other day, when the new Cunard-White Star Heer, the Green Mary, slid down the ways into the water at Clydebank, Scotland, it carried provisions for an elaborate system of protection against fire, Smoke tubes and an immense battery of carbon-dioxide tanks will ride in its giant bull when it takes to the sea on its maiden voyage. In addition, there are special Diesei-driven blebants awang on electrically operated davits of new design At the touch of a lever, an operator can lower one of these boats fully loaded into the water in the space of a few seconds.

Larger than the American plant, the Leviathan, the new vessel is 1,018 feet long. It was built at a cost of \$10,000,000. The ruddet alone weight 250,000 pounds, more than the combined weight of Christ other Cotum tos vessels the tante Maria and the Ama. A special descript the sole of the rudder enables inspectors to enter and examine the interior. With such flesting cities coming from the shippareds, fire protection at sea is of everthateuring importance.

The wresh of the Repulsic, in January 1909 led to the compulsory installation of ship radios. The Titume diseases in April 1917 brought about the satabashment of the International Ice Patrol. And, undoubtedly the Morro Castle tragedy will lead to compulsory adoption of acientific equipment for preventing and fighting first. The price of safety at sea is eternal vipilance—vigilance and the quick adoption of all the aids which acience can offer.

FIRES CAUSED BY BIRDS USING CIGARETTE BUTTS

Boos sometimes cause fires, it is reported by the Railway Fire Protection Amociation, by picking up lighted discrettes and dropping them upon the roofs of buildings. When an abandoned theater was destroyed not long ago in Rockwood, Tenn., spectators reported having seen spatrows, which had nests in the building, pick up lighted discrettes and fly off with them stall burning. In Knosville, Tenn., a railroad engineman is reported by the fire ther as having seen a bird drop a burning discretts on the saves of a house. When he next returned to the city the engineer was surprised to see that the structure had been destroyed by fire.

WARTINIQUE ISLAND HAS VOLCANO MUSEUM

A Unique voicano mineum was recently opened at St. Pierre, on the West Indian island of Martinique. It was here that an eruption of Mt. Peler in 1902 kined 30,000 inhabitants of the town almost instantly. The single survivor found by rescue parties was a prisoner held in an underground dungeon. The museum will contain relies dug from rums of eruptions of Mt. Peler and other famous voicances. The institution was founded by Frank A. Perret, an American attentiat who has conducted researches at Mt. Vesuvius, in Italy, and Mt. Sakurajima, in Japan.

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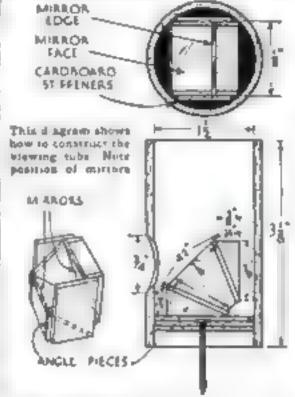
SIMPLE "SKY GLOBE" POINTS OUT STARS

(Continued from page 43)

indicates the line labeled 40, between the dates February 1 and February 15. The upper half of the globe then indicates the principal stars visible at 9 40 P.M. on February I or at 9 P.M. on February 10.

In the same way, when observing at 8 P M., the pointer should indicate a date two weeks earlier to the year. A few moments spent in turning the globe back and forth will make its use planner than a great deal of explanation.

The essential featstre of the sky globe which enables it to point out the principal stars is that their positions on the globe are the same, in minuture, as the positions of the actual beavenly bodies in the sky. In other words, if you imagine strught lines drawn outward from the globe's center through the stars' potitions indicated upon it, there lines, prolonged



infinitely, would pass through the stars in the sky when the correct date is under the pointer

Since this is so, all we need is something to indicate these lines accurately. This is the pur-

pose of the viewing tube

The viewing tube is simply a short length of mading tube provided with a base containing a projecting stud in its center, This stud fits into any one of the holes punched in the globe's surface through the various star posttions. In addition, the viewing tube is provided with two small bits of mirror placed in the tube in such a way that when the rays from a star or star group enter the end of the tube they are reflected at right angles out of the side to the observer's eye

You may wonder why a single marter set at forty-five degrees in the tube would not do for this purpose. A single mirror would do equally well for single stars, but it would reverse the appearance of every constellation, just as a single mirror reverses the lettering on a store window. Accordingly, the viewing tube should have two entirees. This arrangement corrects the reversal of one marror by another, and shows the star groups just an they appear in the sky,

In addition, the ministure maps of the star groups, in which principal stars appear, are drawn as they appear in the sky Even a person entirely unlamiliar with a constellation can recognize it when the globe points it out through the viewing tube. He has only to compare its star arrangement with the miniature map drawn within the circle covered by the base of the viewing tabe-

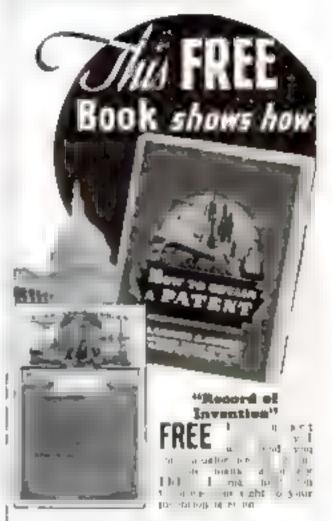
The small rectangular mutors for the viewing tube are easily cut with a ten-cent wheel cutter, and the (Continued on page 130)

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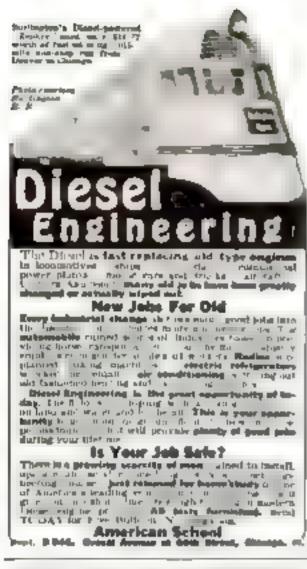
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SIMPLE "SKY GLOBE" POINTS OUT STARS

(Continued from page 229)

mirror chassis gloed together from the various pieces of cardboard, cut accurately to the correct size. When the mirror chassis is dry, it is slid down upon the bottom of the tube and gloed in place with the mirrors facing the side opening

To set up the sky globe on a table or flattopped tripod proceed as follows:

First, make sure that the semicircular scale is set with the proper latitude figure showing through the notch. Then point the axis approximately toward the polestar. Put the viewing tube in position in line with the globe's axis. Slip the stud on the base of the victing tube into the empty hole above the upper end of the globe's axis. Then look into the side opening of the viewing tube and you should see the potestar in the center of the marror If you do not shift the direction of he globe's axis until you do see the posestar at the center of the field. This Jone turn the viewing tube in its socket through a quarter turn and look for the pointar again. It should be in the center of the field when looking into the side opening, no matter which way the viewing tube is turned.

When this condition is met, you are ready to set the proper date under the pointer and transfer the viewing tube to other positions. In each case you will see the star you are looking for when you place the stud of the viewing tube in the proper hole and look through the side opening into the increor

Look on the globe for the name of the star you want to find. Turn up the proper date and hour. Set the viewing tube over the proper circle. Look into the improve, and there's your star with its star group shown just as it is in the sky and just the way you see it on star maps.

FIND RELICS OF ARCTIC EXPLORER LOST IN 1597

RELECT dating back 337 years to the last especiation of Villem Barents, the Dutch es-plorer who is known as the "Columbus of the Arctic," have just been uncovered on Nova Zembia by Russian scientists. Barents, discoverer of Systabergen and the Barents Sea, made three pioneer Journeys into the north, opening it up to European explorers. His list trip in 1507 was an attempt to discover a northeast passage to the Orient. At Nova Zembla, his ships were wrecked and Barents was later killed in an attempt to reach the mainland in a makeshift craft. In 1871, Norwegian. explorers found the site of the Nova Zembla camp and later part of Barents' Journal was discovered. Additional relics of this ill-fated proneer expedition have now been uncovered by a Russian group under the leadership of Boria Miloradovich, twenty-six years old and the youngest man ever to head an Arctic expeditum from Russa

SUGGEST GUNNING WITH CANNON FOR SKY FACTS

Bre Bertha guns, such as hombarded Paris during the World War, could be used to wrest long sought secrets from the mysterious upper regions of the air, U. S. Wenther Bureau experts believe, Projectales would be harled twenty-four miles into the air by the huge guns. They would carry devices for bringing back to earth samples of air and indications of how the winds blow at extreme elevations in addition, new light would be shed on the layer of arone that is supposed to mist between twenty-two and thirty-seven miles above the earth and the composition of guest forming the stratosphere would be revealed, the weather men contend.

GUS TELLS WHAT TO DO IF YOUR STARTER BALKS

(Continued from sage 64)

is closed and the threaded shall turns, but the weighted gear tends to stand still. That screws the gear out on the shall where it finally meshes with the flywheel teeth and turns the motor

"Naturally, as soon as the engine starts firing under its own power, the flywheel goes faster than the starter motor spindle. That screws the starter grat backwards on the shaft, disengages the teeth, and lets the flywheel run free."

"But what's this spring for?" asked Dave, pointing to a heavy coll half hadden by the starter motor housing

"That's a sort of shock absorber," explained Gus. "Takes up the sudden lerks when the two gears mesh. Now, to get back to your trouble, for some reason or other, the counterweighted gear on this drive got jammed in the flywheel teeth. It wouldn't resease, and it wouldn't let the starter motor turn the flywheel,"

"Well, how did tocking the car loosen it?"

That's simple," Gur said. "With the gears in high, the flywheel rigided back and forth every time we rocked the car Gradually, it moved enough to ease the pressure and the counterweighted gear turned back out of the way."

Maybe that thread on the shaft beeds a

little oil," suggested Dave.

Gus shook his head, "Not on your life! An automatic drive on a planter motor is one part on a car that works best without oil. That counterweighted gear should acrew out easy a but not the russis. I you use light on the gear will say out on the thread Bras you we good at the hope of a never tack of oil that makes a starter drive stick.

Well, theo, what does?" questioned Dave.
"Ob, lots of things. Wear, mostly. Sometimes the shaft gets bent and binds and sometimes a broken tooth on the flywheel rather the jam. The trouble generally starts when somebody steps on the starter when the

motor's Chining

"It's something else in your case, though," he said. "See the deep nick at the end of that tooth? That's probably what made it such this morning. Better drop down when you have the time and let me put in a new one. For the time being 1'll leave it alone so you can use the car.

"But suppose it jams again?" protested

Dave

"Then just put her in high and rock her," advised Gus, "if that doesn't looses her up, theorew the top mounting stud 4 bit and rock her some more. It may not happen again for several days, or even weeks. It all depends on the positions of the starter year and the flywheel."

"SAY, Gus, a while back you said that some cars didn't have starters like this. What kind do they have?"

"Manually operated drive grars," replied Cass. "The same pedal that closes the startermotor switch pushes the starter pear into mesh with the flywheel. Then when you let up on the pedal, a spring pushes it out of mesh.

Well live and learn" sighed Morrison. "This is the first time I we ever had trouble with a starter, but I think 121 know what

to do if it happens again."

"Starters are almost fool-proof these days,"
said Gis., "There aren't many troubles you
can have and when they do crop up, they're
easy to recognize."

For instance?"

"We! Gus pondered, "that shock-absorbing spring vou (Continued on page 131)









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GUS TELLS WHAT TO DO IF YOUR STARTER BALKS

(Continued from page 130)

saw can break, but you'll know it as soon as it happens. When you step on the starter, you'll hear the starter spin, but it won't turn the engine. A gummy or dirty shaft on the starter will produce the same result.

"If the starter doesn't run at all when you push the button, it's a good sign there's a break in the wiring, either inside the motor, at the switch, or in some of the connections. Of course, that's taking for granted that the battery isn't dead.

"Sometimes, you come across a case where the starter motor turns, but only cranks the engine slowly. That's generally caused by weak brush springs, an open field or armature winding, or a dirty commutator."

"BY the way, Gus," put in Morrison, "now that winter's about here, is there anything I can do to put that starter in shape for told weather?"

"Starters don't need much attention," said Gus. "Outside of the gasoline bath I'll give the starter shaft to clean it when you bring the car in for that new year, all the care it'll need will be a few drops of good motor oil every five hundred miles or so.

"About the best insurance against hard winter starting," added Gus, as he climbed abourd the wrecker, "is a top-notch battery and a generator that's been adjusted to make up for all the juice used turning over a cold engine. Check up there when you put anti-freeze in your radiator and light oil in your crankcase,"

AVERAGE AUTO SPEED IS THIRTY-FIVE AN HOUR

Ir you are an average motorist, you cruise at thirty five miles an hour. That is the conclusion of recent tests reported by Prof. A. N. Johnson, of the University of Maryland, Forty-one thousand vehicles were timed traveling along the Maryland highways by a special speed detector developed for the purpose. One per cent of the vehicles were found to be going more than lifty-five miles an hour; twelve per cent between forty-five and fifty-five; forty-three per cent between thirty-five and forty-five; thirty-six per cent between twentyfive and thirty-five and eight per cent between fifteen and twenty-five. The overwhelming majority of the cars were traveling in the neighborhood of thirty-five miles an hour, which is accepted by the Highway Research flourd of the state as the present average on the highways. The tests are expected to provide data that will be valuable in highway planning and accident prevention work.

FLIGHT OF WATERFOWL BAFFLES EXPERTS

THERE see birds which broke the distance record for homing pigeons were recently studied by experts of the Carnegie Institution, of Washington, D. C. Taken from their nesting grounds in Florida, the three terms were put through tests to determine their reaction to various stimuli. Then, after being bunded, they were released from a ship off Cape Hatteras, 1,081 miles to the north. Five days later, they were seen back at the nesting place on Bird Key. The record for pigeons is 1,010 miles. In their tests, the scientists were not able to discover any special sensitiveness on the part of the birds to sound, smell, light or other stimuli, which might account for their feat. Their marvelous ability to span long stretches of sea and land as though following a compass is classed as an instinct and still Inchies, science.



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Earth's Last Drop of Oil To Be Recovered

(Continued from page 32)

this herculean task be accomplished?

By fewer and larger wells, by applying back pressure to the wells, by repressuring, by driving oil up one well as gas is forced down another, by mining for oil much as one digs

gold and silver from the earth.

Experiments undertaken by Uren and Prof. A. J. Carlson of the University of California have led to some interesting discoveries. The California scientists are studying each of the retentive forces separately in an effort to determine the effect of each and to learn bow it influences the flow from a field. They measure the permeability of various kinds of sands, determine the interfacial, or surface, tension between oil and water with a delicate tensiometer, even measure the porosity, or void space between the sand grains, to learn exactly how much oil a given stratum will contain under known pressure.

HERE they place a small quantity of oil-saturated sand in one end of the porosimeter, tilt the instrument and read the total volume on two tubes. Now they remove the sample, dry it thoroughly, grind the sand to tiny pieces and again measure the new votume. The difference between the first and second readings indicates the original amount of open space.

But the studies do not stop here. Uren has gone into the fields to study conditions of production and then returned to his miniature oil field and conical tube and there he has submitted the questions to these remarkable

machines.

The miniature field, for instance, reveals that larger wells have both a larger initial and greater ultimate recovery. The conical tube shows that in the larger wells the gas pressure is more evenly distributed through the sand. From these results Uren concludes that half the number of wells now sunk can be made to produce more oil than present wells at half the cost.

They show, also, that more oil can be taken from a well if it is not permitted to flow at full capacity. Back-pressuring by restricting the flow increases the ultimate recovery as

much as half,

By varying the back pressure on the conical tube and measuring the pressure at different distances from the wall of the well, represented by one end of the tube, it is found that we can alter the form of the preseure gradient and obtain through the reservoir rock a more equal distribution of the energy that forces oil outward," Uren explained.

The conical tube has yielded other interesting information. While it represents the flow through one square inch on the wall of a normal well, Uren has found that from it he not only can predict very definitely what goes on during drainage but also can determine the radius from which one well would

draw its supply.
"We seek," he told me, "some means of controlling both the rate of flow and the expansion of gas. Back-pressuring is one influence. With the tube we get right down into the oil and, study the pressure gradient and obtain primary data. You can appreciate the importance of this when you realize that half the pressure is lost within five feet of the wall of an ordinary well. Our problem is to distribute this pressure loss over as wide an area as possible. By holding back on the flow, we are able to get more uniform expansion of gas, which means that we use only enough gas to bring the oil into the well, saving the rest as a driving force for later use."

That is the reason Uren advocates fewer and larger wells. Here are the results of two experiments conducted in the ministure field which support his conclusion:

A three-inch well two minutes after it was

beought in was flowing at the rate of 17,000 cubic centimeters a minute, and forty-eight minutes later was producing 200 c.c. a minute. A one-inch well was producing 5,200 and 100 at the same intervals of time. The total production was equivalent to several months' production of full-sized wells in the field.

Again, two buby wells, in size three inches and one iach respectively, produced totals of 70,080 and 35,725 cubic centimeters of oil.

In some of the older American fields, efforts have been made to restore the pressure of exhausted oil sands by bringing natural gas from new fields and forcing it down old wells. Experiments with the miniature field indicate that old wells may be repressured many



X-Ray Pictures Now Made Full Length

Modern z-ray technique makes it possible to take a full-length z-ray picture with a single exposure and on a single film. In the picture above, the subject's wrist watch, bracelet, and shoes can be seen.

times, each repressuring resulting in the recovery of additional quantities of oil. This rsethod alone has yielded as much as half the total quantity available, or two and a half times that which flows by pressure and pump-

AMERICA'S future oil supply, Uren says, will probably be derived by mining. Though more expensive than production through wells, the animing method offers greater possibilities for recovering oil from the vast underground treasure chambers than do any others.

Here oil miners sink shafts and drive drifts, either directly into oil-bearing rock or above and below the strata to be tapped, and drain the oil through mine openings. Unlike mining for metals, the sand is not removed. Already two such mines are being operated, one in Alsace and the other near Hanovey, Germany, One of these mines, in the Pechelbroun field, is among the world's largest mining enter-

One large American company has been seeking means, not only for reviving oil fields by this method, but also of tapping new sources. Fields not yet drilled are being staked out for exploitation when rising prices and a depleted national supply make the method economically feasible.

MINING for oil has been proved a success in the Pechelbronn fields. During the war the wells there became practically exhausted, Germany, then in control of Alsace, decided to bring up the remaining oil through a vast system of mine shafts and galleries, Today ninety miles of these galleries have been built in that project. Since the war, France has continued to extend these mines until the secondary recovery of oil has amounted, in some areas, to three times that which originally flowed up through the wells.

"This method," said Uren, "has great pos-sibilities for the United States in the lean years to come. Oil mining will become a large industry when there no longer are flush fields to exploit. Oil will become more expensive,

but there will be oil."

He has studied mining methods in Europe and surveyed several hundred American fields to determine where they may be applied. Most practical operations, he finds, can be conducted in the upper 2,000 feet of the earth's surface. Beyond that depth the expease mounts and at great depths the heat rises too high for ordinary mining methods.

As men tunnel into the earth for oil, much of the mystery surrounding its occurrence disappears. In the European fields, exploited in the upper 800 feet, the operators find oil in large lenses, some as wide as seventy-five feet and 1,000 feet long. Although very tough when in place, the sand, when removed, may be broken easily by the fingers. In one part of the Pechelbrosa field, four wells sunk into these lenses produced 147,000 barrels. In the following three years, 338,800 barrels were taken from the same area by mining. Here the operators drive shafts directly into the oilbearing sand, cut it up by drifts and shafts into blocks 160 feet square and drain off the oil on all four sides.

Oil mining has already been found practi-cable by older methods in the United States. Several years ago the Union Oil Company of California drew oll from Sulphur Mountain, near Ventura, through thirty-one tunnels. Near Newport Beach, Calif., J. Sharkey sunk a shaft at an angle of forty-five degrees and drew oil from the sand after heating the nearby rock with steam coils, thus making the oil less viscous so that it flows more freely, At Ravenna, Ky., a shaft was sunk 130 feet and some oil obtained.

Exactly how much oil will be removed from a given field through mining cannot always be foretold accurately, though it sometimes may be forecast from the amount of gas which escapes from the wells. Knowing the pressure existing to the oil reservoir, petroleum engineers can determine bow much oil is required to hold a given amount of gas in solution. A bazrel of oil under high pressure may contain 1,000 cubic feet of natural gas, or more, the amount depending upon the

Seemingly unrelated studies, these. But, added together, they present a remarkable picture of the mysterious processes that have been going on under the earth through countless centuries and show how man may yet draw the last drop of oil from these hidden

pressure chambers.

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